DOCUMENT RESUME

ED 285 035 CE 048 160

TITLE	Computer-Aided Drafting. Education for Technology Employment.
INSTITUTION	Northern Illinois Univ., De Kalb. Dept. of Technology.
SPONS AGENCY	Illinois State Board of Education, Springfield. Dept. of Adult, Vocational and Technical Education.
PUB DATE	Jan 87
CONTRACT	77-RH-491
NOTE	359p.; For related documents, see CE 048 157-161.
PUB TYPE	Guides - Classroom Use - Guides (For Teachers) (052)
EDRS PRICE	MF01/PC15 Plus Postage.
DESCRIPTORS	Architectural Drafting; *Competence; Competency Based Education; *Computer Graphics; *Computer Oriented Programs; Computer Software; Designers; *Drafting; Engineering Graphics; Integrated Curriculum; Learning Activities; Microcomputers; Postsecondary Education; Secondary Education; State Curriculum Guides; Technical Occupations
IDENTIFIERS	*Computer Assisted Drafting; Illinois

ABSTRACT

This computer-aided drafting (CAD) curriculum was developed to provide drafting instructors in Illinois with a useful guide for relating an important new technological advance to the vocational classroom. The competency-based learning activity guides are written to be used with any CAD system being used at the secondary and postsecondary levels. The CAD curriculum includes the following components: identified CAD tasks, measurable components of performance, identified objectives, information and activity requirements, and mastery requirements. Appendixes include a troubleshooting guide, mathematics/science concept analysis, a crosswalk relating the state recommended drafting task list with the CAD curriculum, and a list of employability skills. (KC)

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Education for Technology Employment

Illinois State Board of Education

Adult
Vocational and
Technical Education

CAD

COMPUTER-AIDED DRAFTING

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Research and
Development Section
Funding Agreement
Number 77-RH-491
January, 1987

This publication is available from:

CURRICULUM PUBLICATIONS CLEARINGHOUSE
Western Illinois University
Horrabin Hall 46
Macomb IL 61455

800-322-3905 (toll free in Illinois)
309-298-1917 (from outside Illinois)

FOREWORD

This Computer Aided Drafting (CAD) curriculum has been developed to provide drafting instructors with a useful guide for relating an important new technological advance to the vocational classroom. The competency-based learning activity guides are written to be used with any computer aided drafting system being used at the secondary and post-secondary levels. Each instructor must add to the existing activity sheets specific instructions for operating their own unique CAD equipment. This curriculum is designed as one part of a complete drafting program. Some segments of the Guide can be presented without the use of expensive CAD equipment.

Illinois teachers developed this curriculum product based on information obtained from the drafting industry and their knowledge gained from the hands-on training during the summer of 1984. The curriculum was field tested in 29 secondary and post-secondary Illinois schools during the 1984-85 school year.

The Illinois State Board of Education is committed to assisting local communities in the development of quality vocational education programs. The activities outlined in this product have been designed to better prepare persons for employment or further education in drafting-related occupations.

Sincere appreciation is extended to the vocational educators and industry representatives who assisted in the development and field testing of this curriculum.

Ted Sanders

Ted Sanders
State Superintendent of Education

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Illinois State Board of Education

Department of Adult, Vocational and Technical Education
Research and Development Section

Product Abstract

1. Title of material Computer Aided Drafting
2. Date material was completed January 1987
3. Please check one: New material X Revised material ___ Field-tested material X
4. Originating agency Northern Illinois University

Address Department of Technology -- DeKalb, Illinois Zip Code 60115

5. Name(s) of developer(s) Ceretto, Croft, Dietmeier, Ferry, Fessenden, Fox, Gutierrez, Haddick Kolton, Kopf, Kramer, Malitzke, Mufich, Peterson, Ward, Zagorski

Address Jule Dee Scarborough, Director DeKalb, Illinois Zip Code 60115
Dept. of Technology
Northern Illinois University

6. Developed pursuant to Contract Number ___

7. Subject Matter (Check only one according to Department of Education Code):

Code

___ 01 Agricultural Education
___ 03 Business and Office Education
___ 04 Distributive Education
___ 07 Health Occupations Education
___ 09 Home Economics Education
X 10 Industrial Arts Education
X 16 Technical Education
X 17 Trade and Industrial Education
___ 22 Cooperative Education
___ Career Education
___ Other (Specify) ___

8. Education Level:

___ Pre-K Thru 6
X Post-Secondary
___ Administrator (Pre-Service)
___ 7-8
X Adult
___ 9-10
___ Teacher (Pre-service)
___ Other (Specify) ___
X 11-12

9. Intended for Use By:

X Student
___ Teacher Educator
X Classroom Teacher
___ Guidance Staff
___ Local Administrator
___ State Personnel
___ Other (Specify) ___

10. Student Type:

X Regular
___ Limited-English Proficiency
___ Disadvantaged
___ Handicapped
___ Other (Specify) ___

11. Medium and Format of Materials:

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No. of pages 350
___ Paper bound
___ Hard bound
X Loose-leaf
Photos: Yes ___ No ___
Diagrams Yes X No

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___ B & W
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16. General Description (State the general objective and suggested method of use. Summarize the content and tell how it is organized. Continue on back of this sheet or on another sheet, if necessary.):

Competency based computer aided drafting curriculum for grades 11-14 intended for use as an articulation tool

17. Person Completing this Abstract: Jule Dee Scarborough

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Department of Technology--Still Hall 203
Northern Illinois University
DeKalb, IL Zip 60115

INTRODUCTION

This competency-based CAD curriculum has been developed to include the following components:

A. Identified CAD tasks

B. Measurable components of performance

C. Identified objectives

D. Clearly stated information and activity requirements

E. Clearly stated mastery requirements

The materials were intentionally written in a very generic level. It is necessary that you, the instructor, supplement the curriculum with specific information pertaining to your CAD System when it is requested. The Operators Manual or Software Documentation for your system should provide you with all the necessary required information.

The format of the curriculum lends itself to a variety of presentation styles as outlined below:

I. Curriculum Use Variations

   A. Individualized

      1. Give students their own learning guide

      2. Self-paced

      3. Set up suggested time frames

   B. Lecture

      1. Use information sheets as lecture topics/ handouts

    2. Hand out activity sheets/exams or checklists when required

- C. Combination Lecture/Individualized
    - 1. Lecture of broad topics
    - 2. Intense hands-on tasks
- D. Combine tasks as required
    - 1. Short, related tasks
- E. Use tasks pertaining to your equipment
    - 1. Avoid unnecessary/unattainable tasks
- F. Customize this curriculum to your equipment
    - 1. Insert information sheets
    - 2. Identify outside information sources
    - 3. Customize checklist

To help you quickly identify the content and layout of the curriculum, we have defined and illustrated the sections of a typical "learning guide."

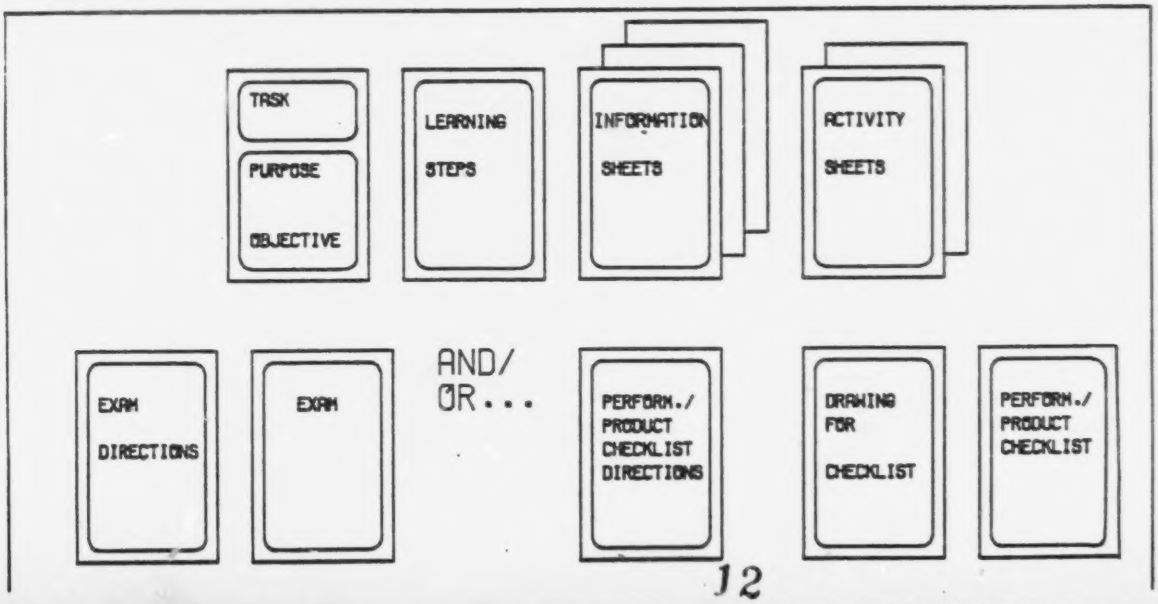
TASK

A descriptive measurable component of performance. The CAD TASK list identifies duty areas ranging from an introduction to CAD through three dimensional CAD. Each task has been developed into a Compentency Based Learning Guide.

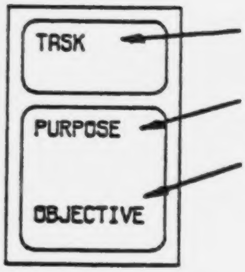
LEARNING GUIDE

Each Student Learning Guide identifies the purpose and objective of the task. Included within the Guide are step-by-step reading and activity procedures to be completed by the student. These activities culminate into a verifiable exam or product checklist to show mastery of the task.

EACH LEARNING GUIDE IS DIVIDED INTO THE FOLLOWING SECTIONS:


TASK
PURPOSE
OBJECTIVE
LEARNING
STEPS
INFORMATION
SHEETS
ACTIVITY
SHEETS
EXAM
DIRECTIONS
EXAM
AND/
OR...
PERFORM./
PRODUCT
CHECKLIST
DIRECTIONS
DRAWING
FOR
CHECKLIST
PERFORM./
PRODUCT
CHECKLIST

LEARNING GUIDE BRIEF


TASK
PURPOSE
OBJECTIVE

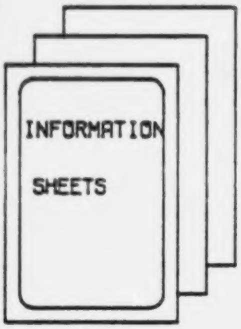
TASK TITLE FOR PARTICULAR LEARNING GUIDE

A STATEMENT IDENTIFYING THE REASON FOR LEARNING THIS TASK

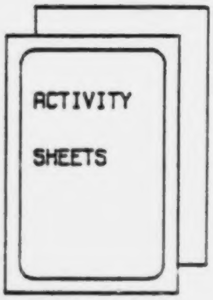
IDENTIFIES EXAM AND/OR PRODUCT CHECKLIST PERFORMANCE LEVEL SUGGESTED FOR MASTERY

LEARNING
STEPS

LISTS A SUGGESTED, PRIORITIZED PROCEDURE USING THIS PARTICULAR LEARNING GUIDE


INFORMATION
SHEETS

CONTAIN READING MATERIAL DIRECTLY RELATING TO TASK DESCRIPTION


ACTIVITY
SHEETS

CONTAIN ACTIVITIES TO BE COMPLETED BY STUDENT WHICH RELATE DIRECTLY TO THE INFORMATION SHEETS

EXAM DIRECTIONS	IDENTIFIES PURPOSE, TYPE AND SUGGESTED MASTERY LEVEL OF EXAM
EXAM	A MULTIPLE CHOICE EXAM RELATING DIRECTLY TO THE TASK INFORMATION AND ACTIVITY SHEETS
	AND/OR
PERFORM./ PRODUCT CHECKLIST DIRECTIONS	IDENTIFIES OBJECTIVE OF THE CHECKLIST, DIRECTIONS FOR STUDENT, SUGGESTED DIRECTIONS FOR EVALUATOR AND SUGGESTED MASTERY LEVEL OF CHECKLIST
PERFORM./ PRODUCT CHECKLIST DIRECTIONS	TO BE COMPLETED ACCORDING TO CHECKLIST DIRECTIONS
DRAWING FOR CHECKLIST	A LISTING OF SPECIFIC REQUIREMENTS TO BE COMPLETED DURING DRAWING ACTIVITY RELATING DIRECTLY TO THE TASK INFORMATION SHEETS

STUDENT LEARNING GUIDE

TASK A 1

DESCRIBE THE OPERATOR-MACHINE INTERFACE IN COMPUTER AIDED DRAFTING

PURPOSE:	In Computer Aided Drafting (CAD), a drafter should know how he/she and computer technology interface to efficiently solve drafting/design problems. Knowledge of what CAD technology is, how it works, and its capabilities are important. This learning guide will explain CAD technologies and the related terms of this operator-machine interface.
OBJECTIVE:	Given a written exam, you will DESCRIBE THE OPERATOR-MACHINE INTERFACE IN COMPUTER AIDED DRAFTING (CAD). To master this exam, you must answer 13 out of 14 items correctly, or achieve a score equivalent to 92%.

LEARNING STEPS

A 1

READ: Information Sheet A 1.1, "Introduction to Computers," for an overview of computers.

COMPLETE: Activity Sheet A 1.2, "Introduction to Computers."

READ: Information Sheet A 1.3, "Introduction to Computer Aided Drafting."

COMPLETE: Activity Sheet A 1.4, "Introduction to Computer Aided Drafting," for a self-check on your progress.

REVIEW: Information Sheets A 1.1, A 1.3, and Activity Sheets A 1.2, A 1.4.

COMPLETE: Written Exam A 1 for mastery of this task; contact your instructor.

INFORMATION SHEET

A 1.1

Introduction to Computers

People must be able to communicate with computers. Interface is the common boundary for this communication. This effective interface will allow operator and machine (computer) to solve problems with increased efficiency.

Computers are machines that handle facts and figures or data. The processing of data has always existed and did not begin with the first electronic computer. Since time began, people have been concerned with the issue of computing.

Data needs to be sorted and arranged so it can be logically understood. When you are adding numbers, you are handling data or "processing information."

The computer receives data (input), processes data, and in turn, produces "information" (output). Likewise, a secretary receives information (input), performs a particular task with the data (processor), and types the results (output). A computer performs the preceding functions without human intervention. This is called "Data Processing."

Computers alone cannot perform a task; they must be given instructions. To get a task done, you must specify the instructions carefully. The computer is simply an extension of a person's ability.

THE IMPORTANCE OF COMPUTERS

1. SPEED - In one hour a computer can perform more operations than a drafter who uses a pencil and paper.
2. PERMANENT MEMORY - A computer remembers both facts and instructions electronically which can be recalled very quickly.
3. ACCURACY - If given the correct information, a computer is much more accurate than the finest digital watch. The computer processes this information according to a set "program." This program is a set of rules input into the computer so it can function.
4. AUTOMATIC - Once a computer is given its instructions and the necessary data, it will automatically process this data until it runs out of data or is shut off.

INFORMATION SHEET A 1.1 (continued)

PARTS OF A COMPUTER SYSTEM

1. **INPUT DEVICE** - A processing device that transfers information (data) from the outside to the inside of a computer. These devices are DIGITIZER BOARD and KEYBOARD.
2. **MEMORY UNIT** - That device where the input data is stored until it is needed for further processing.
3. **ARITHMETIC & LOGIC UNIT** - The device that compares, sorts, and rearranges all stored information. Also, it performs all addition, subtraction, multiplication, and division operations.
4. **CONTROL UNIT** - This part of the computer regulates the flow of information (data) in and out of the INPUT, MEMORY, LOGIC, AND OUTPUT units.
5. **OUTPUT DEVICE** - The device which displays or retains processed data. Some of these devices are PRINTER, PLOTTER, CATHODE RAY TUBE (CRT), DISK DRIVE, and TAPE DRIVE.

ACTIVITY SHEET

A 1.2

Introduction to Computers

1. Define the term "Processing" as it relates to computers.

2. What are computers?

3. The computer is simply a/an ------------------- of a person's ability.

4. What can a computer do without human intervention?

5. Computers need ------------------- before they can perform a task.

6. Name four terms important to computers.

    1. -------------

    2. -------------

    3. -------------

    4. -------------

7. A program is

8. A computer will stop processing data when

    A. -------------

    B. -------------

9. A computer remembers ----------------------- and ----------------- electronically.

ACTIVITY SHEET A 1.2 (continued)

10. Name the five parts of a computer system.

    1. _____________
    2. _____________
    3. _____________
    4. _____________
    5. _____________

11. Define the term interface as it relates to computers.

INFORMATION SHEET

A 1.3

Introduction to Computer Aided Drafting

Drafters, technicians, architects, and engineers have used computers for many years to solve various mathematical problems in relationship to their jobs. The most recent application of the computer is in Computer Aided Drafting, or CAD for short.

The most important concept to understand is that CAD is just another tool in a long line of technological advances that will make a designer or drafter more productive. The computer alone does not make a drawing. Designers and drafters use this tool to draw quickly, neatly, and more accurately. CAD is the automation of traditional drafting tasks.

Principal terms necessary to have a basic understanding of computer aided drafting are listed below. This terminology will assist you in describing the operator-machine interface. Interface is the common boundary between operator and machine or operator and computer. Items included in the operator-machine interface are listed as follows:

1. **COMPUTER AIDED DRAFTING (CAD)** - The graphic representation of design ideas using specialized computer equipment.
2. **COMPUTER** - An electronic machine that has memory, logic, and mathematical capabilities and has been designed to perform related tasks at extremely fast speeds.
3. **CATHODE RAY TUBE (CRT)** - Technical name of the display device or picture tube in a CAD station.
4. **DIGITIZER** - An electronic pad for input of data into the computer.
5. **KEYBOARD** - A console of keys, such as those on a typewriter, attached to the CRT.
6. **HARD COPY** - Copy of the drawing on a data medium such as paper or polyester film.
7. **PLOTTER** - An output unit in a CAD station that draws graphic data on paper.
8. **STYLUS** - An electronic pen-like instrument that, with a tablet, inputs data into the computer.

ACTIVITY SHEET

A 1.4

Introduction to Computer Aided Drafting

1. Sketch and label a CAD station with the following items:

   A. KEYBOARD
   B. CRT
   C. PLOTTER
   D. PROCESSOR
   E. DIGITIZER
   F. STYLUS

2. What does CAD stand for?

3. CAD makes a designer or drafter more ______________.

4. Designers and drafters use CAD to draw _______________, _______________, and _______________.

EXAM

Version 1

Task A 1

Name ______________________________

DIRECTIONS:

THE PURPOSE OF THIS EXAM IS TO DETERMINE WHETHER OR NOT YOU HAVE UNDERSTOOD THE INFORMATION ON THE OPERATOR-MACHINE INTERFACE IN COMPUTER AIDED DRAFTING.

Each of the questions or incomplete statements below is followed by several words, phrases, or a series of numbers. Choose the one which best answers the question or completes the statement correctly. Place the letter associated with that choice (A, B, C, D, or E) in the numbered blank space on your ANSWER SHEET. DO NOT WRITE ON THIS TEST! To master this exam, you must answer 13 out of 14 items correctly, or achieve a score equivalent to 92%.

1. What does CAD stand for?

   A. Compilers
   B. Computer Aided Drafting
   C. Computers and Design
   D. Computers and Drafting
   E. Control and Design

2. Computers need _______ before they can process information.

   A. Control
   B. CRT
   C. Input
   D. Output
   E. Speed

3. The unit which stores information in a computer until it is needed for further processing is the _______ unit.

   A. Control
   B. Input
   C. Logic
   D. Memory
   E. Output

EXAM A 1, Version 1 (continued)

4. A keyboard is ______________.

   A. A compiler
   B. A control unit
   C. An input device
   D. A logic unit
   E. An output device

5. A plotter is _______________.

   A. A computer
   B. A control unit
   C. An input device
   D. A logic unit
   E. An output device

6. The _________________ unit sorts, compares, and rearranges all stored data in the computer.

   A. Computer
   B. Control
   C. Logic
   D. Input
   E. Memory

7. The _________ unit regulates the flow of data in and out of various sections of the computer.

   A. Control
   B. Input
   C. Logic
   D. Computer
   E. Memory

8. _______________ is another name for a display device or monitor for viewing information.

   A. Computer
   B. CRT
   C. Input
   D. Keyboard
   E. Output

EXAM A 1, Version 1 (continued)

9. A person's ability to communicate with computers best describes which of the following terms?

   A. Automatic
   B. Control
   C. Input
   D. Interface
   E. Speed

Match the following column of computer terms with the following column of definitions by placing the letter of the term before the definition.

A. Cathode Ray Tube
B. Computer
C. Digitizer
D. Keyboard
E. Plotter
F. Stylus

_____10. Paper producing unit

_____11. Pen-like device for input

_____12. Console of letters to the computer

_____13. Pad for input to the computer

_____14. Electronic machine for processing information

EXAM

Version 2

Task A 1

Name ________________________________

DIRECTIONS:

THE PURPOSE OF THIS EXAM IS TO DETERMINE WHETHER OR NOT YOU HAVE UNDERSTOOD THE INFORMATION ON **THE OPERATOR-MACHINE INTERFACE IN COMPUTER AIDED DRAFTING**.

Each of the questions or incomplete statements below is followed by several words, phrases, or a series of numbers. Choose the one which best answers the question or completes the statement correctly. Place the letter associated with that choice (A, B, C, D or E) in the numbered blank space on your ANSWER SHEET. DO NOT WRITE ON THIS TEST! To master this exam, you must answer 13 out of 14 items correctly, or achieve a score equivalent to 92%.

1. The _______________ unit sorts, compares, and rearranges all stored data in the computer.

   A. Computer
   B. Control
   C. Logic
   D. Input
   E. Memory

2. What does CAD stand for?

   A. Compilers
   B. Computer-Aided Drafting
   C. Computers and Design
   D. Computers and Drafting
   E. Control and Design

3. __________________ is another name for a display device or monitor for viewing information.

   A. Computer
   B. CRT
   C. Input
   D. Keyboard
   E. Output

EXAM A 1, Version 2 (continued)

4. A plotter is _______________.

   A. A computer
   B. A control unit
   C. An input device
   D. A logic unit
   E. An output device

5. The unit which stores information in a computer until it is needed for further processing is the __________ unit.

   A. Control
   B. Input
   C. Logic
   D. Memory
   E. Output

6. Man's ability to communicate with computers best describes

   A. Automatic
   B. Control
   C. Input
   D. Interface
   E. Speed

7. Computers need __________ before they can process information.

   A. Control
   B. CRT
   C. Input
   D. Output
   E. Speed

8. The _______________ unit regulates the flow of data in and out of various sections of the computer.

   A. Control
   B. Input
   C. Logic
   D. Computer
   E. Memory

9. A keyboard is _______________.

   A. A compiler
   B. A control Unit
   C. An input device
   D. A logic unit
   E. An output device

EXAM A 1, Version 2 (continued)

Match the following column of computer terms with the following column of definitions by placing the letter of the term before the definition.

A. Cathode Ray Tube
B. Computer
C. Digitizer
D. Keyboard
E. Plotter
F. Stylus

_____ 10. Electronic machine for processing information

_____ 11. Console of letters to the computer

_____ 12. Paper producing unit

_____ 13. Pad for input to the computer

_____ 14. Pen-like device for input

STUDENT LEARNING GUIDE

TASK A 2

IDENTIFY CAD APPLICATIONS

PURPOSE: As drafting relates to many industries such as aerospace, machine, and piping, so does COMPUTER AIDED DRAFTING (CAD). CAD technology is a versatile tool which can meet the challenges and demands of many areas of concentration. The various applications for CAD are discussed in this learning guide to give you a better idea of how CAD is used by business and industry.

OBJECTIVE: Given a written exam you will IDENTIFY CAD APPLICATIONS. To master this exam, you must answer 9 out of 9 items correctly, or achieve a score equivalent to 100%.

LEARNING STEPS

A 2

READ:	Information Sheet A 2.1 , "Identify CAD Applications," for information on how CAD is used.
COMPLETE:	Activity Sheet A 2.2, "CAD Applications."
REVIEW:	Information Sheet A 2.1 and Activity Sheet A 2.2, "Identify CAD Applications."
COMPLETE:	Exam A 2 to demonstrate mastery of "CAD Applications." Contact your instructor.

INFORMATION SHEET

A 2.1

Identify CAD Applications

The computer is a tool which has memory, logic, and computing capabilities and can operate at a high rate of speed.

This electronic technology is used in business as an administrative tool for accounting, payroll, budgeting, and record keeping.

Manufacturing uses the computer for numerical control of machines, cost estimations, inventory, quality assurance, product testing, and billing.

Medical applications for the computer include patient records, insurance claims, admitting, discharging, diagnosis, monitoring, and patient medication.

More recently the computer has been used by architects and engineers to solve design problems. The computer is used in each step of the design process. The design process includes problem identification. Here, the computer is used to analyze data. Initial ideas are stored in the computer. CAD is used to prepare various solutions to determine which one is best. Models and prototypes are formulated with the help of CAD. And lastly, CAD is used to produce working drawings and numeric control input for the manufacturing process.

The many uses of CAD are increasing daily as familiarity with this technology is acquired by more and more people. Software is being developed to adapt CAD capabilities to meet the specific needs of more people. The adaptability and potential of CAD make their impact on industry greater than ever.

The following are some applications of CAD:

INDUSTRIAL AREAS

1. Aerospace Applications

    a. Lofting
    b. Structural
    c. Hydraulics

INFORMATION SHEET A 2.1 (continued)

2. Architectural Applications

   a. Residential/commercial
   b. Heating, ventilating, and air conditioning
   c. Structural design/drafting
   d. Topography analysis
   e. Plumbing design/drafting
   f. Lighting design/drafting
   g. Floor plan
   h. Electrical design/drafting
   i. Foundation plan

3. Automotive Applications

   a. Structural
   b. Configuration
   c. Hydraulics
   d. Kinematics
   e. Steering
   f. Tires

4. Civil Applications

   a. Highway construction
   b. Topography
   c. Surveying
   d. Structural layout

5. Electronic Applications

   a. Schematics
   b. Printed Circuit Board design/layout
   c. Numeric Control layout
   d. Integrated Circuit Board design/layout
   e. Testing

6. Mechanical Applications

   a. Machine design
   b. Mold design
   c. Jig and fixture design
   d. Surface development

7. Piping Applications

   a. Liquid/gas
   b. Single line schematics
   c. Double line layout
   d. Isometric layout
   e. Process planning

ACTIVITY SHEET

A 2.2

CAD Applications

1. List five business applications for the computer.

    ----

2. List five medical applications for the computer.

    ----

3. List five manufacturing applications for the computer.

    ----

4. List the three ways the computer is used by architects and engineers in the design process.

ACTIVITY SHEET A 2.2 (continued)

5. List seven industrial areas where CAD is used.

----

6. List four CAD applications for the industrial area of piping.

----

7. List four CAD applications for the industrial area of mechanical.

----

8. List four CAD applications for the industrial area of automotive.

EXAM

Version 1

Task A 2

NAME ________________________________

DIRECTIONS:

THE PURPOSE OF THIS EXAM IS TO DETERMINE WHETHER OR NOT YOU HAVE UNDERSTOOD THE INFORMATION ON **IDENTIFYING CAD APPLICATIONS**.

Each of the questions or incomplete statements below is followed by several words, phrases, or a series of numbers. Choose the one which best answers the question or completes the statement correctly. Place the letter associated with that choice (A, B, C, D or E) in the numbered blank space on your ANSWER SHEET. DO NOT WRITE ON THIS TEST! To master this exam, you must answer 9 out of 9 items correctly, or achieve a score equivalent to 100%.

1. Patient records, insurance claims, and discharge records are all ways the computer is used in the area of

   A. Architectural
   B. Business
   C. Engineering
   D. Manufacturing
   E. Medical

2. The computer is used for payroll, budgeting, and record keeping in the area of

   A. Architectural
   B. Business
   C. Drafting
   D. Engineering
   E. Manufacturing

3. Cost estimating, quality assurance, and product testing are handled by the computer in the area of

   A. Business
   B. Drafting
   C. Engineering
   D. Manufacturing
   E. Medical

EXAM A 2, Version 1 (continued)

4. The computer is used in the design process in all but which of the following activities?

   A. Draw solution
   B. Explain ideas
   C. Make models
   D. Identify problem
   E. Store problem

5. Select the industrial area where CAD is not used.

   A. Automotive
   B. Civil
   C. Electronic
   D. Medical
   E. Piping

6. Floor plan dimensioning relates to which industrial area?

   A. Architectural
   B. Business
   C. Engineering
   D. Manufacturing
   E. Medical

7. Integrated Circuits (IC) and Printed Circuits (PC) relate to which industrial area?

   A. Business
   B. Civil
   C. Electronics
   D. Mechanical
   E. Piping

8. Heating, Ventilating, and Air Conditioning (HVAC) is an application for the computer for which industrial area?

   A. Architectural
   B. Business
   C. Engineering
   D. Manufacturing
   E. Medical

9. Mold design is a computer application for which area?

   A. Business
   B. Drafting
   C. Engineering
   D. Mechanical
   E. Medical

EXAM

Version 2

Task A 2

DIRECTIONS:

THE PURPOSE OF THIS EXAM IS TO DETERMINE WHETHER OR NOT YOU HAVE UNDERSTOOD THE INFORMATION ON IDENTIFYING CAD APPLICATIONS.

Each of the questions or incomplete statements below is followed by several words, phrases, or a series of numbers. Choose the one which best answers the question or completes the statement correctly. Place the letter associated with that choice (A, B, C, D, or E) in the numbered blank space on your ANSWER SHEET. DO NOT WRITE ON THIS TEST! To master this exam, you must answer 9 out of 9 items correctly, or achieve a score equivalent to 100%.

1. Select the industrial area where CAD is not used.

   A. Automotive
   B. Civil
   C. Medical
   D. Piping

2. Mold design is a computer application for which area?

   A. Business
   B. Drafting
   C. Engineering
   D. Mechanical
   E. Medical

3. Patient records, insurance claims, and discharge records are all ways the computer is used in the area of

   A. Architectural
   B. Business
   C. Engineering
   D. Manufacturing
   E. Medical

4. Integrated Circuits (IC) and Printed Circuits (PC) relate to which industrial area?

   A. Business
   B. Civil
   C. Electronics
   D. Mechanical
   E. Piping

EXAM A 2, Version 2 (continued)

5. The computer is used in the design process in all but which of the following activities?

   A. Draw solution
   B. Explain ideas
   C. Make models
   D. Problem identification
   E. Problem storage

6. Heating, Ventilating, and Air Conditioning (HVAC) is an application for the computer for which industrial area?

   A. Architectural
   B. Business
   C. Engineering
   D. Manufacturing
   E. Medical

7. Cost estimating, quality assurance and product testing are handled by the computer in the area of?

   A. Business
   B. Drafting
   C. Engineering
   D. Manufacturing
   E. Medical

8. Floor plan dimensioning relates to which industrial area?

   A. Architectural
   B. Business
   C. Engineering
   D. Manufacturing
   E. Medical

9. The computer is used for payroll, budgeting, and record keeping in the area of

   A. Architectural
   B. Business
   C. Drafting
   D. Engineering
   E. Manufacturing

STUDENT LEARNING GUIDE

TASK A 3

DESCRIBE CAD SYSTEMS

PURPOSE: To better understand how a computer operates and what it can do, it is necessary to recognize basic computer systems. In completing this learning guide, you will be able to describe three basic CAD systems. This information will give the characteristics of each system and the hardware unique to each system. The three basic systems include micro, mini, and mainframe computers.

OBJECTIVE: Given a written exam, you will DESCRIBE CAD SYSTEMS. To master this exam, you must answer 8 out of 8 items correctly, or achieve a score equivalent to 100%.

LEARNING STEPS

A 3

READ: Information Sheet A 3.1, "Types of CAD Systems."

READ: Information Sheet A 3.2, "Glossary of Common CAD terms."

COMPLETE: Activity Sheet A 3.3, "Micro, Mini, and Mainframe CAD Systems."

COMPLETE: Written Exam A 3 to demonstrate mastery of this task. Contact your instructor.

INFORMATION SHEET

A 3.1

Types of CAD Systems

People have kept records and stored information from the beginning of time. Our methods of accounting have varied from keeping a number of rocks, to marks on cave walls, to a string tied with knots. Our progression of the computing process included the abacus in 450 B.C., mechanical devices in the 1600's, Hollerith punched cards in the 1890's, first generation computer (MARK 1), and what we know today as the modern electronic computer. The electronic computer stores information, calculates, and outputs information in a variety of ways.

Present CAD systems are merely tools with applications aimed at drafting and design. CAD/CAM (Computer-Aided Drafting/Computer-Aided Manufacturing) systems are associated with the manufacturing of everything from shoes to aircraft, space vehicles, or architectural structure design and construction.

Different CAD system installations will have basic components which include the computer, Cathode Ray Tube (CRT), storage devices, keyboard, digitizer, plotter, and optional printer.

The main part of any CAD system is called the central processing unit (C.P.U.), which controls all the functions of the system. Central processing units differ in memory capacity (ability to store information) and speed of operation. CAD systems are either mainframe, mini, or microcomputer based. The difference between these systems is in the storage capacity and speed of information processing.

Mainframe based systems have the largest C.P.U. and fastest speed of information processing. Mini computer based systems have a lesser storage capacity and a somewhat slower speed of information processing. The microcomputer based systems have a much smaller storage capacity and process information at a considerably slower rate than either of the other two. Drawing options decrease as the size of the system gets smaller.

Generally, large industries utilize dedicated mini computers or networked mainframe based CAD/CAM systems which are capable of 3-dimensional solid modeling. A mini computer system can be easily set up to handle several CAD/CAM work stations (networked system) which is typical of what is found in today's industrial settings.

INFORMATION SHEET A 3.1 (continued)

Most microcomputer based CAD systems are found in small businesses and educational training facilities. Microcomputers are less expensive to purchase and offer various peripheral devices which increase their flexibility and applications. Software (programs which operate a CAD system) is available and affordable by smaller users.

INFORMATION SHEET

A 3.2

Glossary of Common CAD Terms

Computers have affected almost every area of our lives. Dictionaries are constantly adding new computer terms and definitions. One problem that is encountered in any computer related field is the use of many terms that mean the same thing. Industry realized the problem and decided to standardize certain terms related to CAD.

1. CAD - Computer-Aided Drafting
2. CAM - Computer-Aided Manufacturing
3. C.P.U. - Central Processing Unit
4. DIGITIZER - A device used for inputing a drawing in digital form into a CAD system.
5. GRAPHIC DISPLAY SCREEN - A Cathode Ray Tube (CRT) is a display-screen device which depicts the image of elements being drawn.
6. KEYBOARD - Data entry device which allows information to be entered into a CAD system by depressing one or more typewriter style keys.
7. MAINFRAME SYSTEM - A CAD system controlled by a very large high-speed central processing unit which has its memory capacity measured in megabytes. Such a system is a general purpose computer which controls a variety of different functions in a company.
8. MEMORY - The portion of a computer system in which information can be entered and stored for future use.
9. MICROCOMPUTER - Small personal computer with a memory usually limited from 64 K to 256 K (Bytes). These computers are an inexpensive means of supporting a CAD system.
10. MINI COMPUTER SYSTEM - Computer which has a smaller memory than a MAINFRAME but larger than a MICROCOMPUTER and is used to control most industrial CAD/CAM systems.
11. NETWORKED SYSTEM - A CAD system which has one central processing unit with several work stations, each composed of a keyboard, CRT, and other peripheral devices.

INFORMATION SHEET A 3.2 (continued)

12. PERIPHERAL - The surrounding CAD components that are an operational part of the system such as digitizer, plotter, printer, etc.

13. PLOTTER - An output device which plots out graphics data in the form of a drawing and text on media such as paper, vellum, mylar, etc.

14. PRINTER - Device which produces a copy of the CRT screen display quickly, but usually the copy is of poorer quality than one generated by a plotter.

15. SOFTWARE - A collection of stored data in the form of disk, magnetic tape, etc., which provides instructions for operation of a CAD system.

16. STYLUS - An electronic pen-like instrument that inputs data into a computer.

17. MOUSE - A hand held input device which works off of a table top or digitizer tablet and is used to position the cursor on the screen and input commands.

18. PUCK - A hand operated directional control device to input coordinate data.

ANSI CAD TERMS

The American National Standards Institute (ANSI) is the standardizing body for industry in the United States. The members of ANSI are people that are recognized as experts in their fields. The members of the various ANSI committees survey industry, find the general consensus, and call this the industry standard for whatever tasks they are working on.

To secure a copy of ANSI CAD TERMS contact:

The American Society of Mechanical Engineers
United Engineering Center
345 East 47th Street
New York, NY 10017

for document ANSI Y 14, 26.3-1975

ACTIVITY SHEET

A 3.3

Micro, Mini, and Mainframe CAD Systems

DIRECTIONS: Read information sheet A 3.2 and use available resources in the drafting lab and library to do the following exercises:

1. Define these terms:

   A. MAINFRAME based system

2. List the components which make up a typical CAD system.

   A.

   B.

   C.

   D.

   E.

   F.

   G.

3. Preview any available audiovisual materials on CAD systems. See instructor to obtain these materials.

EXAM

Version 1

Task A 3

NAME ______________________________

DIRECTIONS:

THE PURPOSE OF THIS EXAM IS TO DETERMINE WHETHER OR NOT YOU HAVE UNDERSTOOD THE INFORMATION ON DESCRIBING CAD SYSTEMS.

Each of the questions or incomplete statements below is followed by several words, phrases, or a series of numbers. Choose the one which best answers the question or completes the statement correctly. Place the letter associated with that choice (A, B, C, D or E) in the numbered blank space on your ANSWER SHEET. DO NOT WRITE ON THIS TEST! To master this exam, you must answer 8 out of 8 items correctly, or achieve a score equivalent to 100%.

1. The main part of any CAD system is called the

   A. P.U.C.
   B. C.P.U.
   C. A.A.U.
   D. C.A.D.

2. The C.P.U. controls all the functions of a CAD system.

   A. True
   B. False

3. What type of CAD/CAM system is used in large industrial facilities?

   A. MAINFRAME based
   B. MICROCOMPUTER based
   C. MINI computer based
   D. A and C

4. Most CAD systems used in small business and educational settings are

   A. MAINFRAME based
   B. MICROCOMPUTER based
   C. MINI computer based
   D. MAXI computer based

EXAM A 3, Version 1 (continued)

5. A CAD system which can support several work stations is a

   A. Networked system
   B. Multi-CAD system
   C. Branched system
   D. Variable system

6. Which CAD systems are the least expensive?

   A. MAXI computer based
   B. MINI computer based
   C. MICROCOMPUTER based
   D. MAINFRAME computer based

7. At the present time CAD software programs

   A. Are not available
   B. Are readily available
   C. Are difficult to obtain
   D. Are only available for large systems

8. A CAD system is merely a ___________ used in drafting.

   A. Control
   B. Keyboard
   C. Memory
   D. Peripheral
   E. Tool

EXAM

Version 2

Task A 3

NAME ______________________________

DIRECTIONS:

THE PURPOSE OF THIS EXAM IS TO DETERMINE WHETHER OR NOT YOU HAVE UNDERSTOOD THE INFORMATION ON DESCRIBING CAD SYSTEMS.

Each of the questions or incomplete statements below is followed by several words, phrases, or a series of numbers. Choose the one which best answers the question or completes the statement correctly. Place the letter associated with that choice (A, B, C, D, or E) in the numbered blank space on your ANSWER SHEET. DO NOT WRITE ON THIS TEST! To master this exam, you must answer 8 out of 8 items correctly, or achieve a score equivalent to 100%.

1. At the present time CAD software programs

   A. are not available.
   B. are readily available.
   C. are difficult to obtain.
   D. are only available for large systems.

2. Most CAD systems used in small business and educational settings are

   A. MAINFRAME based
   B. MICROCOMPUTER based
   C. MINI computer based
   D. MAXI computer based

3. Which CAD systems are the least expensive?

   A. MAXI computer based
   B. MINI computer based
   C. MICROCOMPUTER based
   D. MAINFRAME computer based

4. The C.P.U. controls all the functions of a CAD system.

   A. True
   B. False

EXAM A 3, Version 2 (continued)

5. What type of CAD/CAM system is used in large industrial facilities?

   A. MAINFRAME based
   B. MICROCOMPUTER based
   C. MINI computer based
   D. A and C

6. A CAD system is merely a _______________ used in drafting.

   A. Control
   B. Keyboard
   C. Memory
   D. Peripheral
   E. Tool

7. A CAD system which can support several workstations is a

   A. Networked system
   B. Multi-CAD system
   C. Branched system
   D. Variable system

8. The main part of any CAD system is called the

   A. P.U.C.
   B. C.P.U.
   C. A.A.U.
   D. C.A.D.

STUDENT LEARNING GUIDE

TASK A 4

DESCRIBE THE ROLE OF CAD SYSTEM PERSONNEL

PURPOSE:	In order for you to develop an understanding of the interaction between CAD system personnel and equipment, you must learn the qualifications and responsibilities of these people. While all these people work with CAD, each uses it in a different way.
OBJECTIVE:	Given a written exam, you will DESCRIBE THE ROLE OF CAD SYSTEM PERSONNEL. To master this task, you must answer 8 out of 8 items correctly, or achieve a score equivalent to 100%.

LEARNING STEPS

A 4

READ:	Information Sheet A 4.1 on "CAD System Personnel," for an overview of job responsibilities.
COMPLETE:	Activity Sheet A 4.2, "CAD System Personnel."
COMPLETE:	Written Exam A 4, "CAD System Personnel," to demonstrate mastery of this task. Contact your instructor.

INFORMATION SHEET

A 4.1

CAD System Personnel

Personnel associated with CAD systems consists of a systems manager, graphics designer, graphics operator and programmer. The training and job responsibility will vary with each position.

Systems Manager

Principal duties and responsibilities

1. Supervises entire CAD system
2. Loads appropriate software
3. Clears system for use of graphic work stations
4. Notifies operators that the system is ready for use
5. Logs into the system
6. Prepares backup to magnetic tapes
7. Reports hardware problems and software bugs
8. Evaluates, organizes, and schedules CAD operations
9. Provides application programs
10. Maintains history files

Typical qualifications

1. Sufficient knowledge of industrial processes
2. Trained in CAD operations
3. Two to four years' experience in graphics or technical education
4. Possesses leadership abilities
5. Programming knowledge

Graphics Designer

Principal duties and responsibilities

1. Develop, maintain, and document application procedures
2. Establish communication formats for transfer of information between the computer graphics facility and users
3. Train and provide guidance to assigned personnel in the operation of equipment and application procedures
4. Schedule work for assigned personnel and maintain a work-history file
5. Maintain data in accordance with standard procedures for their assigned applications
6. Assure the accuracy and quality of all graphics produced by assigned personnel
7. Review incoming jobs for clarity of interpretation and conformation to established standards

INFORMATON SHEET A 4.1 (continued)

8. Determine tasks which can be automated via user commands
9. Perform the duties of a graphics operator when required

Typical qualifications
1. Meet the qualifications for a graphics operator
2. Perform satisfactorily as a graphics operator for a minimum of eighteen months, or have a minimum of five years' experience in engineering graphics, or possess a two-year technical degree with three years of experience

Graphics Operator

Principal duties and responsibilities
1. Operates a computer graphics terminal to create, modify, delete, transfer, and plot graphics files
2. Prepares graphics files from sketches, prints, or established procedures and standards
3. Performs system startup, system shutdown, disk swapping, and magnetic tape operations
4. Confers with graphics service user
5. In addition, a graphics operator may be required to perform the duties of a graphics plotter operator

Typical qualifications
1. High school graduate
2. Two years' engineering graphics experience or equivalent technical education
3. Typing skills preferred
4. Successfull completion of on-the-job training program
5. Knowledge of industrial drafting standards

CAD Programmer

Principal duties and responsibilities
1. Develop, maintain, and document application programs
2. Train and provide guidance to assigned personnel in the operation of the program
3. Maintain and update programs
4. Assure the accuracy and quality of the program
5. Adapt and modify programs to accomplish desired company production objectives

INFORMATION SHEET A 4.1 (continued)

Typical qualifications

1. Two to six years' education or training in computer programming
2. Experience and/or knowledge of industrial processes
3. Knowledge of industrial drafting standards

ACTIVITY SHEET

A 4.2

CAD System Personnel

1. Research and write job descriptions and qualifications of CAD personnel by using the following resources:

   A. School library
   B. Local public library
   C. Industry
   D. Newspaper
   Show your job descriptions to your instructor for comment.

2. List at least five duties/responsibilities for each of the following:

   A. Systems Manager
   B. Graphics Designer
   C. Graphics Operator
   D. CAD Programmer

3. List at least 3 qualifications for each of the following:

   A. Systems Manager
   B. Graphics Designer
   C. Graphics Operator
   D. CAD Programmer

EXAM

Version 1

Task A'4

NAME ________________________________

DIRECTIONS:

THE PURPOSE OF THIS EXAM IS TO DETERMINE WHETHER OR NOT YOU HAVE UNDERSTOOD THE INFORMATION ON **DESCRIBE THE ROLE OF CAD SYSTEM PERSONNEL**.

Each of the questions or incomplete statements below is followed by several words, phrases, or a series of numbers. Choose the one which best answers the question or completes the statement correctly. Place the letter associated with that choice (A, B, C, or D) in the numbered blank space on your ANSWER SHEET. DO NOT WRITE ON THIS TEST! To master this exam, you must answer 8 out of 8 items correctly, or achieve a score equivalent to 100%.

Match the following job description with the job title in the blank provided.

	Title		Description
_____ 1.	Systems Manager	A.	Develop procedures, communicate ideas, determine tasks
_____ 2.	Graphic Operator	B.	Supervision of entire CAD system
_____ 3.	Graphic Designer	C.	Operate a computer terminal, input information, prepare files from sketches
_____ 4.	CAD Programmer	D.	Assure accuracy and quality of the program, adopt and modify programs to accomplish desired objectives

EXAM A 4, Version 1 (continued)

Match the job title with the job qualifications in the blank provided.

		Title		Description
-----	1.	CAD Programmer	A.	Leadership abilities
-----	2.	Systems Manager	B.	Typing and computer operation skills
-----	3.	Graphic Operator	C.	Computer programming skills with industrial process experience
-----	4.	Graphic Designer	D.	Graphic operation and engineering experience

EXAM

Version 2

Task A 4

NAME ______________________________

Match the job title with the typical job description by placing the letter of the description on the line before the job title.

	Title		Description
____1.	Systems manager	A.	Understand system commands and be capable of editing symbols of fundamental drafting
____2.	Graphics operator	B.	Train and provide guidance to assigned personnel in the operation of equipment and applicationprocedures
____3.	Graphics designer	C.	Adopt and modify program to accomplish desired objectives
____4.	CAD programmer	D.	Supervision of entire CAD system

Directions:

Match the job title with the typical job qualification by placing the letter of the qualifications on the line before the job title.

	Title		Qualifications
____5.	CAD programmer	A.	H.S. grad; 2 yrs. engineering experience; typing skills
____6.	Systems manager	B.	5 yrs. experience or 2 yr. technical degree
____7.	Graphics operator	C.	Leadership abilities
____8.	Graphics designer	D.	2-6 yrs. education or training in computer programming

STUDENT LEARNING GUIDE

TASK A 5

IDENTIFY THE COMPONENTS OF A CAD WORK STATION

PURPOSE:	To use a CAD system effectively you need a knowledge of and the ability to recognize the various hardware components which make up a typical CAD system. When you know what each component does and how it works, you will have a better working knowledge of the entire CAD system.
OBJECTIVE:	Given a written exam, you will IDENTIFY THE COMPONENTS OF A CAD WORK STATION. To master this task, you must answer 15 out of 18 items correctly, or achieve a score equivalent to 83%.

LEARNING STEPS

A 5

READ: Information Sheet A 5.1, "Input Devices."

COMPLETE: Activity Sheet A 5.2, "Identifying Types of Input Devices."

READ: Information Sheet A 5.3, "CAD Components," to identify the components of a CAD work station.

COMPLETE: Activity Sheet A 5.4, "CAD Components," for a self-check on the CAD components.

COMPLETE: Written Exam A 5.5, "Identify Components of a CAD Work Station," to demonstrate mastery of this task. Contact your instructor.

INFORMATION SHEET

A 5.1

Input Devices

All CAD systems contain three major components. These three components are input devices, a processing unit, and output devices.

Input devices are used to enter data into the central processing unit (CPU). The most common input devices in use are the following:

1. Keyboard
2. Digitizer tablet
3. Light pen
4. Joystick
5. Trackball/thumbwheel
6. Stylus
7. Puck
8. Mouse

1. **KEYBOARD:** A typewriter device which allows the user to enter letter (alpha) and number (numeric) instructions to the CPU. A keyboard is the most commonly used input device.

2. **DIGITIZER TABLET:** (Graphics Tablet): A small, flat piece of equipment resembling a lap board. It is used to digitize or convert graphical data into digital data. A digitizing tablet is a larger version of the tablet that is used to copy existing drawings.

3. **LIGHT PEN:** A photo sensitive device which enters data directly onto the screen by pressing the pen point onto the screen at the desired location.

4. **JOYSTICK:** An input device which directly controls the cursor displayed on the monitor.

5. **TRACKBALL AND THUMBWHEELS:** Electromechanical devices which control movement of the cursor on the screen.

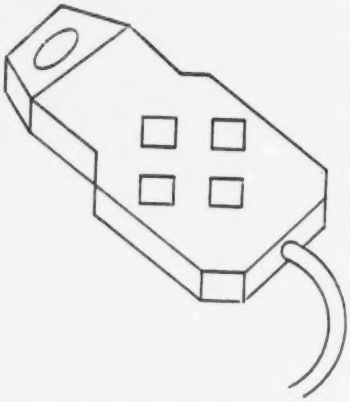
6. **STYLUS:** An electronic pen-like instrument that, with a tablet, inputs data to the computer.

7. **PUCK:** Hand-operated directional control device used to input coordinate data.

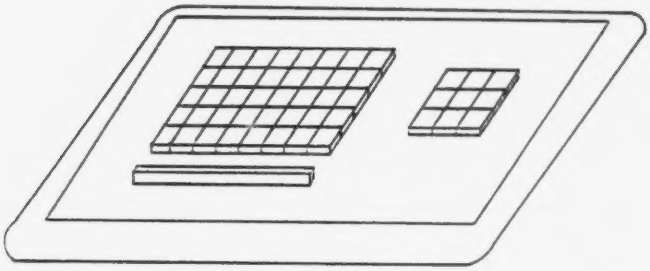
8. **MOUSE:** A hand-held input device which works off of a table top or digitizer tablet.

INFORMATION SHEET A 5.1 (continued)

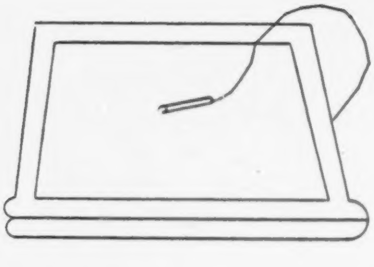
The pictures below are input devices. These devices are used to enter data into a CAD system.



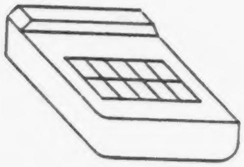
A. PUCK



B. KEYBOARD

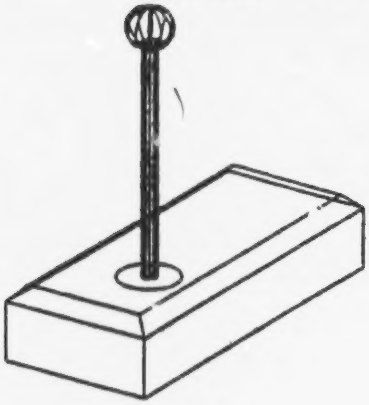


C. DIGITIZER/GRAPHICS TABLET WITH STYLUS

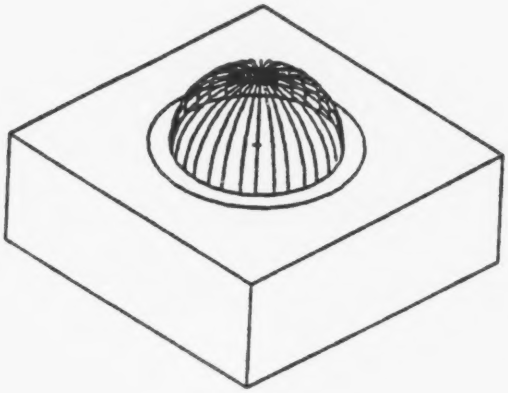


D. FUNCTION BOARD

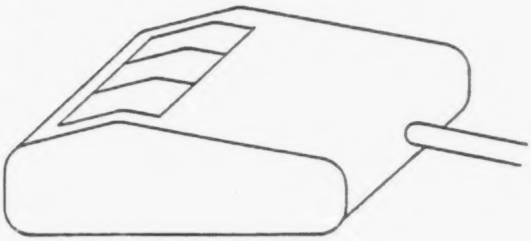
INFORMATION SHEET A 5.1 (continued)



E. JOYSTICK



F. TRACKBALL



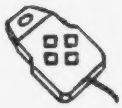
G. MOUSE

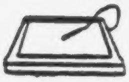
ACTIVITY SHEET

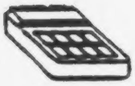
A 5.2

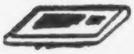
Identifying Types of Input Devices

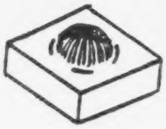
DIRECTIONS: Write the name of each input device shown below on the space provided.

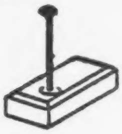
1. 

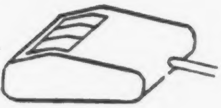
2. 

3. 

4. 

5 

6. 

7. 

INFORMATION SHEET

A 5.3

CAD Components

CENTRAL PROCESSING UNIT

The central processing unit (CPU), or computer, receives all data and manages, manipulates, and controls all functions of the CAD system. It receives function commands entered by the operator and enables the system to perform the functions.

CPU's are classified as MICRO, MINI, or MAINFRAME.

OUTPUT DEVICES

In most instances, the user of a CAD system will need a record of images that are stored in memory or displayed on the graphics monitor. If the record is an actual drawing on paper, it is called a hard copy. The output devices in use are as follows:

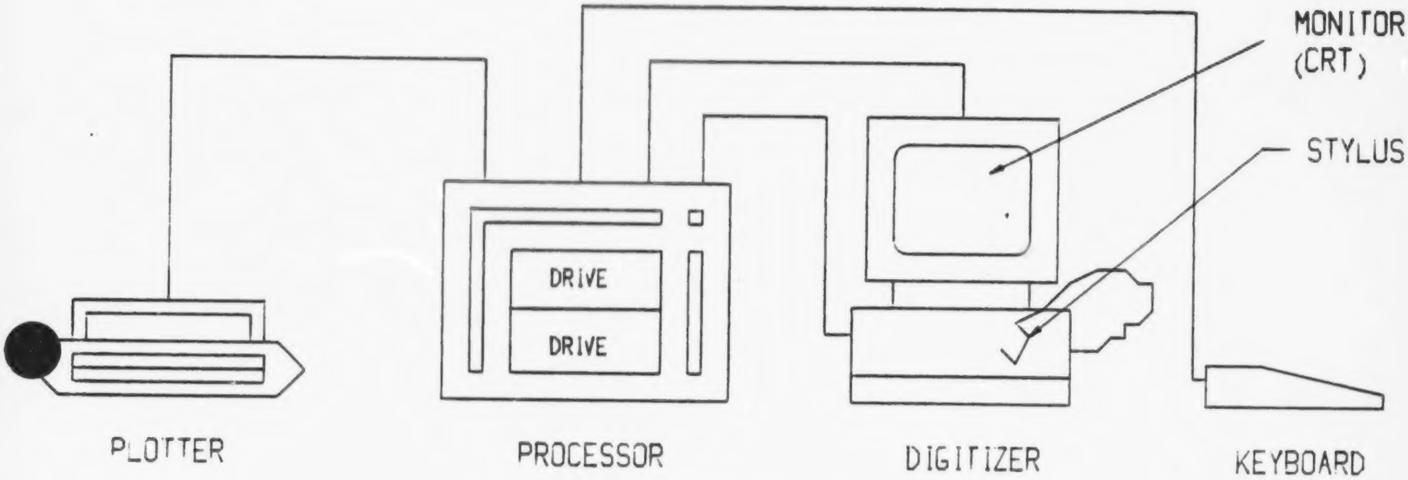
1. Display monitor
2. Plotter
3. Printer

1. **DISPLAY MONITOR:** A Cathode Ray Tube or CRT. This is actually an output device in that data can be entered and manipulated on the monitor, and it also displays the processed data in graphical form. Display monitors fall into one of three main classifications: Raster-scan devices, Vector-refresh or Stroke writing, and Direct view storage tubes (DVST).

2. **PLOTTERS:** A plotter is an electromechanical output device. The plotter will reproduce a hard copy of the graphic image stored in the computer. Plotters may be classified as drum, microgrip, or flatbed type.

3. **PRINTERS:** A printer will produce a hard copy of the CRT display. A printer is faster and more covenient, but does not approach the level of quality produced by a plotter.

INFORMATION SHEET A 5.3 (continued)


MONITOR
(CRT)
STYLUS
DRIVE
DRIVE
PLOTTER
PROCESSOR
DIGITIZER
KEYBOARD

CAD CONFIGURATION

ACTIVITY SHEET

A 5.4

CAD Components

1. In your own words define the following terms:

    A. Keyboard

    B. Digitizer Tablet

    C. Light Pen

    D. Joystick

    E. Trackball/Thumbwheel

    F. Stylus

    G. Puck

    H. Mouse

2. What is the most common device used for data entry?

ACTIVITY SHEET A 5.4 (continued)

3. What is the computer term for data entry?

4. Identify the input device(s) used with your CAD system.

5. List three types of output devices in use today.

   A.
   B.
   C.

6. Another word for CRT is ______________________________

   ____.

7. The CAD term for a drawing produced from a computer is ___

   ____.

8. Monitors, or CRT's, are input/output devices that fall into one of three main classifications:

   a. ____________________ b. _______________________

   c. _______________________.

9. Another word for CPU is __________________________________.

10. The computer receives all data and _________ , ____________,

    and ____________________ all functions of the CAD system.

11. Three classes of CPU's are ______________, ______________,

    and ______________________.

12. The computer is also called the ___________________________

    ____.

EXAM

Version 1

Task A 5

NAME ________________________________

DIRECTIONS:

THE PURPOSE OF THIS EXAM IS TO DETERMINE WHETHER OR NOT YOU HAVE UNDERSTOOD THE INFORMATION ON **IDENTIFYING A CAD WORK STATION**.

DO NOT WRITE ON THIS TEST! To master this exam you must answer 15 out of 18 items correctly, or achieve a score equivalent to 83%.

Identify the following devices as either input(I), processing (P), or output (O) devices, by checking each device.

I, P, O

1. Plotter ________________
2. Digitizer Tablet ________________
3. Trackball ________________
4. Central Processing Unit ________________
5. Joystick ________________
6. Printer ________________
7. Light Pen ________________
8. Keyboard ________________
9. Display Monitor ________________
10. Thumbwheel ________________
11. Stylus ________________
12. Puck ________________
13. Mouse ________________

EXAM A 5, Version 1 (continued)

Match the computer terms on the left with the definitions on the right.

----14. Keyboard

----15. Central Processing Unit

----16. Display Monitor

----17. Digitizer Tablet

----18. Plotter

A. Converts graphical data into digital data

B. Produces a hard copy of a graphics image

C. Allows user to enter letter and number instructions

D. Manages, manipulates, and controls all functions of the CAD system

E. Displays processed data in graphical form

EXAM

Version 2

Task A 5

NAME ________________________________

DIRECTIONS:

> THE PURPOSE OF THIS EXAM IS TO DETERMINE WHETHER OR NOT YOU HAVE UNDERSTOOD THE INFORMATION ON IDENTIFYING A CAD WORK STATION.
>
> DO NOT WRITE ON THIS TEST! To master this exam, you must answer 15 out of 18 items correctly, or achieve a score equivalent to 83%.

Identify the following devices as either input (I), processing (P), or output (O) devices by checking each device.

I P O

1. Plotter ________________
2. Puck ________________
3. Light Pen ________________
4. Stylus ________________
5. Digitizer Tablet ________________
6. Central Processing Unit ________________
7. Printer ________________
8. Keyboard ________________
9. Trackball ________________
10. Display Monitor ________________
11. Thumbwheel ________________
12. Joystick ________________
13. Mouse ________________

EXAM A 5, Version 2 (continued)

Match the computer terms on the left with the definitions on the right.

14.	Central Processing Unit	A.	Converts graphical data into digital data
15.	Plotter	B.	Produces a hard copy of a graphics image
16.	Display Monitor	C.	Allows user to enter letter and number instructions
17.	Keyboard	D.	Manages, manipulates, and controls all functions of the CAD system
18.	Digitizer tablet	E.	Displays processed data in graphical form

STUDENT LEARNING GUIDE

TASK A 6

MAINTAIN AND CARE FOR A CAD SYSTEM

PURPOSE: Extreme care must be taken operating or when moving about a CAD system. Both the software and the hardware components are expensive and require careful handling. An understanding of the proper care and maintenance procedures will insure a positive learning experience for you, and a long life for the system.

OBJECTIVE: Given a written exam, you will IDENTIFY MAINTENANCE PROCEDURES FOR A CAD SYSTEM. To master this exam, you must answer 9 out of 10 items correctly, or achieve a score equivalent to 90%.

LEARNING STEPS

A 6

READ: Information Sheet A 6.1, "Maintain and Care for a CAD System," for information on the maintenance and care of CAD hardware and its environment.

COMPLETE: Activity Sheet A 6.2, "Care and Maintenance of Hardware and its Environment."

READ: Information Sheet A 6.3, "Care and Maintenance of Floppy Disks."

COMPLETE: Activity Sheet A 6.4, "Care and Maintenance of Floppy Disks."

REVIEW: Information Sheets A 6.1 and A 6.3, and Activity Sheets A 6.2 and A 6.4.

COMPLETE: Written Exam A 6 for mastery of this task. Contact your instructor.

INFORMATION SHEET

A 6.1

Maintain and Care for a CAD System

Care and maintenance procedures regarding hardware and its environment.

Environment (classroom/lab):

Most of the factors affecting the CAD system's environment are not under the control of the operator. There are, however, certain rules which must be observed

1. Wash hands before using the system.
2. Static electric build up can affect the performance of the equipment. Periodic touching of a metal surface will eliminate the problem.
3. Magnetic devices (magnetic tip screwdriver, etc.) can seriously damage the software or computer and should not be brought into the classroom/lab.
4. Under no circumstances should food or drinks be brought into the classroom/lab.
5. Never place books, coats, etc., on equipment.
6. Damp or wet clothing should not be worn in the classroom/lab.
7. Replace dust covers when equipment is not in use.
8. Never move the equipment unless done so under the supervision of an instructor.
9. Don't lean on the equipment
10. Don't strike or tap on equipment.
11. Never use abrasive cleaning materials on equipment.
12. Report any observable damage and missing parts to instructor immediately.
13. No horseplay!

INFORMATION SHEET A 6.1 (continued)

Hardware: Only a small portion of the hardware's maintenance is considered part of the operator's responsibility. Certain measures, however, must be observed to keep the equipment operating at peak efficiency.

CPU

1. Remove dust and dirt with a soft damp cloth which has been rung thoroughly.
2. Stubborn marks can be removed with a mild detergent solution.
3. Prevent blockage of air circulation vents.
4. Replace dust cover when work is completed.

CRT

1. Remove finger prints and dust with a soft damp cloth which has been rung thoroughly.
2. Never touch screen with pencils, pens, markers, etc.
3. Use anti-static spray by applying spray to a cloth and then to the screen.

TABLET

1. Remove dust and dirt with a soft damp cloth which has been rung thoroughly.
2. Check for and carefully remove any twist in the stylus/puck cord.
3. Clean stylus and stylus tip periodically.
4. Use anti-static spray, applied to a soft cloth, to clean tablet and menu board.
5. Degauss (demagnetize) the tablet.

PLOTTER

1. Don't lean or place anything on plotting bar.
2. Lift plotter by the sides and not by plotting bar.
3. Keep pen caps on pens when not in use.
4. To allow for paper movement keep immediate area clean.

INFORMATION SHEET A 6.1 (continued)

MOUSE

1. Clean roller balls periodically.
2. Clean work surfaces periodically.
3. Remove finger prints and dust.

ACTIVITY SHEET

A 6.2

Care and Maintenance of Hardware and Its Environment

1. As a CAD operator, you can prevent moisture damage to the equipment by

   a.

   b.

   c.

2. You can prevent heat buildup by

   a.

   b.

   c.

3. You can prevent electro-magnetic damage to the equipment by

   a.

   b.

4. You can prevent dust and dirt buildup by

   a.

   b.

5. You can prevent physical damage to the equipment by

   a.

   b.

   c.

INFORMATION SHEET

A 6.3

Maintain and Care for a CAD System

Care and Maintenance of "Floppy" Disks.

Both the program software disks and the disks you will be using for storage require special care. Without proper handling they can be seriously damaged or even destroyed.

1. When not actively in the drive, disks must be kept in their envelopes to protect them from dust or damage.
2. Disks must not be exposed to direct sunlight, extreme temperature changes, magnetic fields or fluids.
3. Never touch the open area on the disk jacket.
4. Never write on the jacket or on the envelope when the disk is inside.
5. Do not fold, bend, staple, or use paper clips on a disk.
6. Do not place disk on CPU, CRT, tablet, or other peripherals.
7. Do not remove disk from drive while unit is operating.

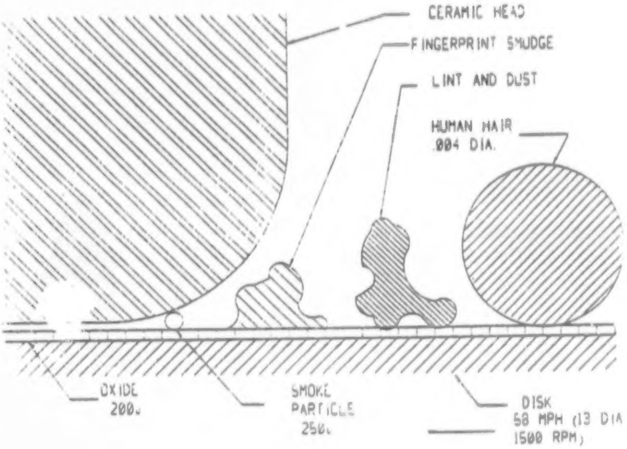

CERAMIC HEAD
FINGERPRINT SMUDGE
LINT AND DUST
HUMAN HAIR
.004 DIA.
OXIDE
200μ
SMOKE
PARTICLE
250μ
DISK
58 MPH (13 DIA
1500 RPM)

Fig. A 6.1 Contaminants which would cause the Head to jump, skip, or score disk, which may cause disk drive malfunctions.

ACTIVITY SHEET

A 6.4

Care and Maintenance Procedures of Floppy Disks

1. Disks should be protected from exposure to
    1.
    2.
    3.
    4.
2. When handling a disk, be careful not to
    1.
    2.
    3.
3. Never place a disk on
    1.
    2.
    3.

EXAM

Version 1

Task A 6

NAME ______________________________

DIRECTIONS:

THE PURPOSE OF THIS EXAM IS TO DETERMINE WHETHER OR NOT YOU HAVE UNDERSTOOD THE INFORMATION ON **HOW TO MAINTAIN AND CARE FOR A CAD SYSTEM**.

Each of the questions or incomplete statements below is followed by several words, phrases, or a series of numbers. Choose the one which best answers the question or completes the statment correctly. Place the letter associated with that choice (A, B, C, D, E, F, G, H, I or J) in the numbered blank space on your ANSWER SHEET. DO NOT WRITE ON THIS TEST! To master this exam, you must answer 9 out of 10 items correctly, or achieve a score equivalent to 90%.

---- 1. Protect from direct sunlight and temperature extremes

---- 2. Use anit-static spray applied to a cloth

---- 3. Carefully remove twists from the cord

---- 4. Never touch open area

---- 5. Report missing or damaged parts

---- 6. Lift by the sides only

---- 7. Protect from heat buildup

---- 8. Clean with soft damp cloth

---- 9. When not in drive, what the disk should be in

----10. Do only under direct supervision of instructor

A. Envelope

B. Stylus

C. Plotter

D. CPU

E. Tablet or screen

F. Disk

G. Instructor

H. All hardware

I. Disk jacket

EXAM

Version 2

Task A 6

NAME ______________________________

DIRECTIONS:

THE PURPOSE OF THIS EXAM IS TO DETERMINE WHETHER OR NOT YOU HAVE UNDERSTOOD THE INFORMATION ON MAINTAIN AND CARE FOR A CAD SYSTEM.

Ten maintenance or care procedures are listed below. Match the procedure with the appropriate term, and place the letter in the place provided. DO NOT WRITE ON THIS TEST! To master this exam, you must answer 9 out of 10 items correctly, or achieve a score equivalent to 90%.

____ 1. Do only under direct supervision of instructor

____ 2. Don't block air circulation vents on

____ 3. Report missing or damaged parts

____ 4. Never touch open area on the

____ 5. Static electric buildup can affect the performance of the equipment

____ 6. Do not fold, bend, staple, use clips, or write on

____ 7. Degauss periodically

____ 8. Carefully remove twists from the cord

____ 9. Keep pen caps on pens when not in use

____10. When not the drive, disks should be in this

A. Plotter

B. CPU

C. Stylus/Puck

D. Periodic touching of a metal grounded surface

E. Envelope

F. Tablet

G. Floppy disk

H. Disk jacket

I. To instructor

J. Move components

STUDENT LEARNING GUIDE

TASK A 7

DESCRIBE COMMAND PROCESSES

PURPOSE: In order to operate a CAD system, the operator must know the specific procedures necessary to create a drawing. These procedures are referred to as commands and functions.

OBJECTIVE: Given a written exam, you will DESCRIBE COMMAND PROCESSES USED IN CAD. To master this task, you must answer 9 out of 9 items correctly, or achieve a score equivalent to 100%.

LEARNING STEPS

A 7

READ:	Information Sheet A 7.1, "Commands and Functions."
COMPLETE:	Activity Sheet A 7.2, "Commands and Functions," for a self-check on CAD commands and functions.
COMPLETE:	Written Exam A 7 on command processes to demonstrate mastery of this task. Contact your instructor.

INFORMATION SHEET

A 7.1

Commands And Functions

A typical CAD system includes many command and function options. First, we must identify what is meant by the following terms:

COMMAND: Instruction used to initiate a specific action.

FUNCTION: The producing of a change on a CRT screen. This always follows a command.

SYNTAX: A set of rules and procedures which must be followed in order to operate a CAD system properly.

MENU: A list of various commands or functions that are available to the operator.

Commands and functions work hand-in-hand. This is an example of how the command/function relationship works:

```
COMMAND--------FUNCTION--------INPUT DEVICE--------OUTPUT


                LINE              KEYBOARD            IMAGE ON
ADD----------- CIRCLE---------- JOYSTICK        ----SCREEN  OR
                POINT             DIGITIZING PAD      HARD COPY
```

In this example, when the ADD command is selected, the operator has three function command options.

In a typical main menu, there will be several choices of commands or functions. These command and function procedures must be followed exactly, or an error will occur. These errors are referred to as syntax errors. When this occurs, the operator should review the procedure used and revise it.

INFORMATION SHEET A 7.1 (continued)

COMMANDS

There are many general commands which are common to CAD systems. These include the following:

SAVE - Allows the computer to store information from the main memory in computer to some type of storage; i.e., floppy disk, cassettes, etc.

LOAD - Allows the computer to input information from storage system to the computer's memory.

DELETE - Erases the memory of the computer up to the present moment.

EDIT - Allows the operator to make changes to a drawing.

HELP - Provides information to the operator dealing with a specific function.

CATALOG - Allows the computer to list the files that are in storage.

PRINT - To produce a hard copy of a CAD drawing using a printer.

DISPLAY - A visual output on a CRT screen.

ACTIVITY SHEET

A 7.2

Commands and Functions

DIRECTIONS: Read information Sheet A 7.1, and refer to your operator's manual to complete the following exercises.

1. Define the following terms

   A. Function

   B. Command

   C. Syntax

2. What is a syntax error?

3. List 5 commands that are common to CAD systems.

   A.

   B.

   C.

   D.

   E.

4. List 5 commands used with your particular CAD system.

   A.

   B.

   C.

   D.

   E.

EXAM

Version 1

Task A 7

NAME ______________________________

DIRECTIONS:

THE PURPOSE OF THIS EXAM IS TO DETERMINE WHETHER OR NOT YOU HAVE UNDERSTOOD THE INFORMATION ON DESCRIBE COMMAND PROCESSES.

Match the terms in the left column with the definition in the right column. Place the letter associated with that choice (A, B, C, D, E, F, G, H, I or J) in the numbered blank space on your ANSWER SHEET. DO NOT WRITE ON THIS TEST! To master this exam, you must answer 9 out of 10 items correctly, or achieve a score equivalent to 90%.

___1. Syntax

___2. Function

___3. Load

___4. Catalog

___5. Display

___6. Command

___7. Save

___8. Print

___9. Delete

A. Allows computer to place information from main memory in computer to some type of storage

B. Series of instructions used to initiate a specific action

C. Erases the memory of the computer upto thepresent moment

D. Allows the computer to input information from storage system to the computer's memory

E. The producing of a change on CRT screen. (This always follows a command.)

F. A set of rules and procedures which must be followed in order to operate a CAD system properly

G. The computer will list the files that are in storage

H. To make a hard copy of machine output

I. A visual output as seen on a CRT screen

EXAM

Version 2

Task A 7

DIRECTIONS:

THE PURPOSE OF THIS EXAM IS TO DETERMINE WHETHER OR NOT YOU HAVE UNDERSTOOD THE INFORMATION ON **DESCRIBE COMMAND PROCESSES**.

Match the command process with the appropriate term, and place the letter in the place provided. DO NOT WRITE ON THIS TEST! To master this exam, you must answer **9** out of **10** items correctly, or achieve a score equivalent to or 90%.

___1. Display
___2. Load
___3. Command
___4. Syntax
___5. Print
___6. Catalog
___7. Delete
___8. Save
___9. Function

A. Allows computer to place information from main memory in computer to some type of storage

B. Series of instructions used to initiate a specific action

C. Erases the memory of the computer up to the present moment

D. Allows the computer to input information from storage system to the computer's memory

E. The producing of a change on CRT screen (this always follows a command).

F. A set of rules and procedures which must be followed in order to operate a CAD system properly

G. The computer will list the files that are in storage

H. To make a hard copy of machine output

I. A visual output as seen on a CRT screen

STUDENT LEARNING GUIDE

TASK A 8

START UP, LOG/ON, RETRIEVE, SAVE, LOG/OFF AND SHUT DOWN A CAD SYSTEM

PURPOSE: In order to create any drawing on a CAD system, you must be able to start up and log/on. You will also want to retrieve a drawing, save a drawing and log/off, and shut down your CAD system.

OBJECTIVE: Given a CAD system, you will start-up, log/on, retrieve, store, log/off, and shut down the CAD system. To master this task, you must score 9 out of 9 points on a peformance checklist, or achieve a score equivalent to 100%.

LEARNING STEPS

A 8

READ:	Information Sheet A 8.1, "Log/On, Log/Off Procedures."
READ:	CAD System Operator's Manual, "Log/On, Log/Off Procedures."
READ:	Information Sheet A 8.2, "Retrieve from and Save to a Storage File."
READ:	Operators' Manual, "Storage and Retrieval Systems."
COMPLETE:	Activity Sheet A 8.3, "Log/On, Log/Off Procedures."
COMPLETE:	Activity Sheet A 8.4, "Storage and Retrieval Systems."
COMPLETE:	Performance Checklist A 8, Start up, Log/On, Retrieve, Save, Log/Off and Shut Down a CAD System.

INFORMATION SHEET

A 8.1

Log/On, Log/Off Procedures

At the beginning of each day the CAD operator must turn on the power switch in order to begin work on the CAD system. The computer must be aware that someone wants to interact, or work with it. A computer is similar to any electrical device in that it has to be "plugged in" to a power source. Since the computer is slightly more complicated than a light bulb or toaster, a series of operations other than turning on a switch, may be necessary.

Once the power switch is turned on, the computer must be told what computer language is being used, what application software will be used, and what components will be activated. The method of giving the computer this information is called "BOOTING" in computer terminology. The computer may then store this information in main memory or "talk" to a disk or tape that contains that information.

When the computer has been booted, the operator may or may not have to LOG/ON. The logging on process lets the computer know with whom it is interacting. A logging on process may require the operator to give a name, and possibly a password or secret code, before the computer recognizes the operator.

LOGGING OFF of a computer does not shut down a computer; it is the way the computer is told that the current operator is through with it.

To SHUT DOWN a system usually means to turn off the system.

Consult your Operator's Manual for the operations necessary to start up, boot, log/on, log/off, and shut down the system.

INFORMATION SHEET

A 8.2

Retrieve from and Save to a Storage File

A computer's memory does not contain actual drawings. It contains electronic data which, when processed, will produce an image on the screen.

The work appearing on the screen can be placed into storage by following this general procedure:

1. Select the appropriate command from the menu. It will be shown as a term such as FILE, STORE, SAVE.
2. Follow the instructions which will appear on the screen to guide you through the storage procedure.
3. Follow the instructions which will normally include the entry of a name or part number.
4. Press END or RETURN. The drawing is now stored in the memory.

Drawings can be RETRIEVED from the drawing storage file and displayed on the screen by following this general procedure:

1. Select the appropriate command from the menu. It will be a term such as OLD DRAWING, CALL, RECALL.
2. Follow the instructions which will appear on the screen to guide you through the retrieval procedure.
3. Follow these instructions which will normally include giving the drawing name or part name.
4. Press END or RETURN. The stored drawing will now appear on the screen.

The above is a general procedure. See your Operator's Manual for the specific command entries on your CAD system.

ACTIVITY SHEET

A 8.3

Log/On, Log/Off Procedures

Directions: Consult your Operator's Manual for specific instructions on the operations listed below. Write the instructions for each procedure.

1. Start Up

2. Boot

3. Log/On

4. Log/Off

5. Shut down

ACTIVITY SHEET

A 8.4

Storage and Retrieval Systems

Consult the Operator's Manual for your specific CAD system and answer the following:

List the steps for storing a drawing on your CAD system.

1. --
2. --
3. --
4. --

List the steps for retrieving a drawing on your CAD system.

1. --
2. --
3. --
4. --

TASK: START UP, LOG/ON, RETRIEVE, STORE, LOG/OFF AND SHUT DOWN A CAD SYSTEM

TASK # A 8

PERFORMANCE/PRODUCT CHECKLIST

STUDENT'S NAME ___________________ PERFORMANCE ATTEMPT 1 2 3 4

EVALUATOR'S NAME _________________ DATE OF ATTEMPT ______________

OBJECTIVE:

Given a CAD system, you will START UP, LOG/ON, RETRIEVE, STORE, LOG/OFF, AND SHUT DOWN A CAD SYSTEM.

DIRECTIONS TO THE STUDENT:

Before attempting this task for mastery, carefully review this checklist. You will be evaluated on the basis of this checklist. When you feel you are ready for evaluation, contact your instructor. You must score at least 9 out of 9 points, or achieve a score equivalent to 100% for mastery.

DIRECTIONS TO THE EVALUATOR:

The student will contact you when ready for evaluation. The student must score 9 out of 9 points, or achieve a score equivalent to 100%.

PERFORMANCE/PRODUCT CHECKLIST

A 8

CRITICAL ITEMS	ITEMS TO BE OBSERVED OR CHECKED	RATING YES	RATING NO
1.	Turned on power	---	---
2.	Booted system (inserted disk into drive, if necessary)	---	---
3.	Logged on	---	---
4.	Retrieved drawing from storage (Instructor furnished drawing)	---	---
5.	Stored drawing	---	---
6.	Logged off	---	---
7.	Removed/returned disk to storage	---	---
8.	Turned off power	---	---
9.	Student worked alone	---	---

TOTAL POINTS EARNED -------

POINTS NEEDED FOR MASTERY __9___

STUDENT LEARNING GUIDE

TASK A 9

USE A DRAWING FILE SYSTEM

PURPOSE: A considerable amount of time is spent in creating a drawing on a CAD system. At times a drafter must quit working on one drawing and go to another. To save the work already accomplished, the drafter files the drawing on a disk or tape. Use of the drawing file saves the drafter time and effort from unnecessary duplication.

OBJECTIVE: Given a CAD system and a drawing, you will USE AND MANAGE A DRAWING FILE SYSTEM. To master this task, you must score 11 out of 11 points on a performance checklist, or achieve a score equivalent to 100%.

LEARNING STEPS

A 9

READ: Information Sheet A 9.1, "Use and Manage a Drawing File System."

COMPLETE: Activity Sheet A 9.2 to increase your understanding of file systems.

READ: Operator's Manual on filing for your specific system on filing.

COMPLETE: Activity Sheet A 9.3, "Drawing File System."

COMPLETE: Performance Checklist, A 9, "Use and Manage a Drawing File System," to demonstratemastery of this task.

INFORMATION SHEET

A 9.1

Use and Manage a Drawing File System

Storage of drawings is a problem in every drafting department. Companies using manual drafting usually store their drawings in special metal filing drawers where the drawings stand in a vertical position or lie flat. These filing cabinets are maintained and managed just as a regular file cabinet in a business office.

A CAD system contains a file cabinet, but it is different from the typical office filing cabinet. The computer sets up a file automatically. Once the operator tells the computer that a drawing should be saved or stored, the computer checks its file and inserts the drawing data into the correct place within the file.

The CAD operator's role in file management includes the following: tell the computer whether the drawing is a new or old drawing, whether the drawing is associated with another drawing or group of drawings, what the file name is, and who worked on it. This file can then be stored on a disk or tape. This method of data file management for CAD is easier, faster, and takes up much less space than traditional methods.

Drawings previously created on a CAD system do not become permanent until they are stored (filed); then they can be retrieved for future use. Methods of storing drawings created on a CAD system include:

1. Saving on floppy or hard disks
2. Saving on magnetic tape

Storing drawings on tape is not generally used in CAD systems due to the difficulty in randomly accessing data from a tape. Disks provide a method of rapid random access of the information. This method of file management is common to most micro and mini-based CAD systems.

Most CAD systems in use today store drawings in either drawing file (workfile, datafile) or in a library. Drawings saved in a workfile can be retrieved, revised (added to or deleted from), or merged with other drawings in the file or with newly created drawings. Drawings can be entirely removed (deleted) from a file or saved again and stored back into the file.

INFORMATION SHEET A 9.1 (continued)

A common practice in most CAD systems allows the operator to create a library. The library may contain many stored symbols or drawings which are repeatedly needed to make schematic diagrams and other drawings. Refer to Task B 9 for specific information on component libraries.

Refer to your Operator's Manual for specific instructions regarding file management.

ACTIVITY SHEET

A 9.2

Drawing File Systems

Answer the following questions on drawing file systems:

1. What types of file systems are used to store drawings if you are not using CAD?

2. List the procedure a CAD operator must perform while managing a file system.

3. What is the disadvantage in using magnetic tape storage for CAD files?

4. What is a data file in a CAD system?

5. Define the term library:

6. List 4 ways information in a CAD drawing file can be manipulated.

    A.

    B.

    C.

    D.

7. Explain how a CAD file system is superior to storing drawings on microfilm or file cabinets.

ACTIVITY SHEET

A 9.3

Drawing File System

1. List the proper procedures for file management, using the Operator's Manual of your classroom CAD system. Have your instructor check your work.

2. Contact your instructor and use the above procedure to create and work within a file system.

TASK: USE A DRAWING FILE SYSTEM

TASK # A 9

PERFORMANCE/PRODUCT CHECKLIST

STUDENT'S NAME ________________ PERFORMANCE ATTEMPT 1 2 3 4

EVALUATOR'S NAME _______________ DATE OF ATTEMPT ________________

OBJECTIVE:

Given a CAD system and a drawing, you will USE A DRAWING FILE SYSTEM.

DIRECTIONS TO THE STUDENT:

Before attempting this task for mastery, carefully review this checklist. You will be evaluated on the basis of this checklist. When you feel you are ready for evaluation, contact your instructor. You must score at least 11 out of 11 points, or achieve a score equivalent to 100%, for mastery.

DIRECTIONS TO THE EVALUATOR:

The student will contact you when ready for evaluation. The student must score 11 out of 11 points, or achieve a score equivalent to 100%, for mastery.

PERFORMANCE/PRODUCT CHECKLIST

A 9

CRITICAL ITEMS	ITEMS TO BE OBSERVED OR CHECKED	RATING	
		YES	NO
1.	Turned power on		
2.	Inserted proper disks		
3.	Logged on		
4.	Activated system file management		
5.	Input new/old drawing into file		
6.	Stored drawing from file		
7.	Recalled drawing from file		
8.	Logged off		
9.	Removed/stored disks properly		
10.	Turned power off		
11.	Student worked alone		
	TOTAL POINTS EARNED		
	POINTS NEEDED FOR MASTERY	11	

STUDENT LEARNING GUIDE

TASK A 10

USE CAD OPERATING MODES

PURPOSE: When using a CAD system, you must be familiar with all the operating modes (commands) to create, save, and modify drawings. This learning guide will assist you in using those operating modes.

OBJECTIVE: Given a CAD system, you will USE CAD OPERATING MODES. To master this task, you must score 15 out of 15 points, or achieve a score equivalent to 100% on a peformance checklist.

LEARNING STEPS

A 10

READ:	Classroom CAD Operating Manual on inputting lines, circles, and arcs.
COMPLETE:	Activity Sheet A 10.1, "Geometric Patterns."
REVIEW:	Classroom CAD Operating Manual on inputting lines and circles.
COMPLETE:	Activity Sheet A 10.2, "Geometric Patterns."
COMPLETE:	Activity Sheet A 10.3, "Practice Block."
REVIEW:	Classroom CAD Operating Manual on inputting lines, circles, and arcs.
COMPLETE:	Performance Checklist A 10, "USE CAD OPERATING MODES," to demonstrate the mastery of this task.

ACTIVITY SHEET

A 10.1

Specific Input Devices

After reading the Operating Manual and observing teacher demonstration, input the following data using proper input commands:

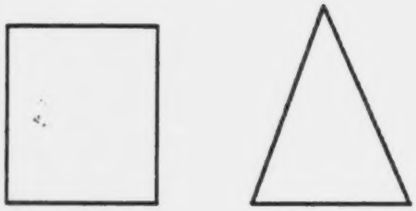
1. Horizontal line
2. Vertical line
3. Diagonal line
4. Rectangle
5. Circle
6. Arc

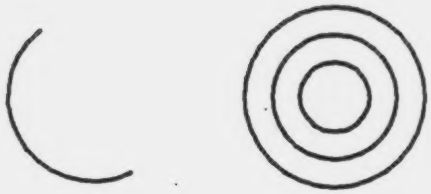
ACTIVITY SHEET

A 10.2

Geometric Patterns

Reproduce the geometric patterns shown below. There are no dimensions. There is no scale. Check with instructor before going to Activity Sheet A 10.3.



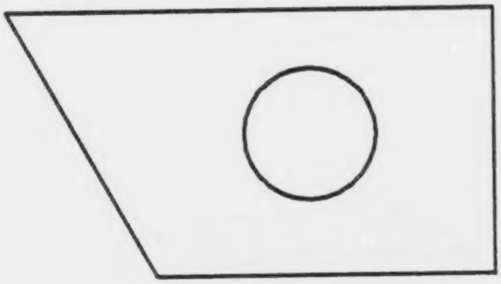


ACTIVITY SHEET

A 10.3

Practice Block

Read Operator's Manual on inputting lines and circles, and produce the drawing below (no scale).



TASK: USE CAD OPERATING MODES

TASK # A 10

PERFORMANCE/PRODUCT CHECKLIST

STUDENT'S NAME ________________ PERFORMANCE ATTEMPT 1 2 3 4

EVALUATOR'S NAME _______________ DATE OF ATTEMPT _______________

OBJECTIVE:

Given a CAD system, you will USE CAD OPERATING MODES.

DIRECTIONS TO THE STUDENT:

Before attempting this task for mastery, carefully review this checklist. You will be evaluated on the basis of this checklist. When you feel you are ready for evaluation, contact your instructor. You must score at least 15 out of 15 points, or achieve a score equivalent to 100% for mastery.

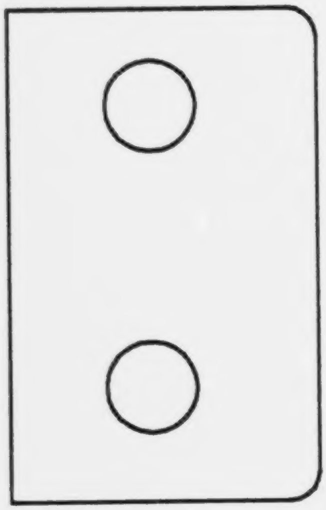
DIRECTIONS TO THE EVALUATOR:

The student will contact you when ready for evaluation. The student must score 15 out of 15 points, or achieve a score equivalent to 100%.

CHECKLIST DRAWING

A 10

Produce the drawing below. Have your instructor check the drawing on the CRT. (No scale or dimensions are required.) You will be evaluated by checklist A 10.



PERFORMANCE/PRODUCT CHECKLIST

A 10

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
1.	Turned on power	--- ---
2.	Used proper disks	--- ---
3.	Logged on	--- ---
4.	Produced lines	--- ---
5.	Made vertical lines	--- ---
6.	Made horizontal lines	--- ---
7.	Drew circles	--- ---
8.	Drew arcs	--- ---
9.	Made arcs tangent to vertical and horizontal lines	--- ---
10.	Lines make corners	--- ---
11.	Stored drawing	--- ---
12.	Logged off	--- ---
13.	Turned power off	--- ---
14.	Returned disks to proper storage area	--- ---
15.	Student worked alone	--- ---
	TOTAL POINTS EARNED	-------
	POINTS NEEDED FOR MASTERY	---15--

STUDENT LEARNING GUIDE

TASK B 1

SET UP A TWO DIMENSIONAL GRID SYSTEM

PURPOSE: The grid option on CAD systems serves as a visual aid to the drafter. By creating a horizontal and vertical reference grid on the screen, the operator can position elements on this grid in much the same way that a manual drafter does on graph paper. This visual drafting aid will be used in future drawings on the CAD system.

OBJECTIVE: Given a CAD system, you will SET UP A TWO DIMENSIONAL GRID SYSTEM. To master this task, you must answer 9 out of 9 items correctly, or achieve a score equivalent to 100%. You must also score 5 out of 5 points on a performance checklist, or achieve a score equivalent to 100%.

LEARNING STEPS

B 1

READ: Information Sheet, B 1.1, "Grids."

READ: Operator's Manual, "Grids," to see how your CAD system activates grids.

COMPLETE: Activity Sheet B 1.2, "Activate Grids."

COMPLETE: Written Exam B 1 on grids and product checklist B 1, "Set Up a Two Dimensional Grid System," to demonstrate mastery of this task. Contact your instructor.

INFORMATION SHEET

B 1.1

Grids

A GRID is used on a CAD system to enable the CAD operator to locate points and dimensions on a CRT screen. A grid is a series of evenly-spaced points that light up on the CRT. The grid, when visible on the CRT, appears as the corner points of graph paper. These points are representative of distances in the horizontal and vertical plane. The points can be spaced to represent any value the operator desires.

In the visible mode, the grid points are visible on the screen and will not appear on the hard copy from the plotter. There may be an invisible mode where the grid points do not appear on the screen.

CAD systems have a snap mode which is a function that will cause the cursor to snap to the nearest incremental grid point. When the snap mode is not activated, the cursor remains in the free mode.

The grid is very important to the operator because it shows the vertical and horizontal location of the cursor. It also can be used as a measuring instrument.

ACTIVITY SHEET

B 1.2

Activate Grids

1. List in correct sequence the commands for activating the grid.

2. List the command(s) for making the grid visible.

3. After your instructor checks your above answers, activate the following grids on your screen and have your instructor check them.

   A. 1 x 1

   B. .5 x .5

   C. .25 x .25

TASK: SET UP A TWO DIMENSIONAL GRID SYSTEM

TASK # B 1

PERFORMANCE/PRODUCT CHECKLIST

STUDENT'S NAME _______________ PERFORMANCE ATTEMPT 1 2 3 4

EVALUATOR'S NAME _______________ DATE OF ATTEMPT _______________

OBJECTIVE:

Given a CAD system, you will SET UP A TWO DIMENSIONAL GRID SYSTEM.

DIRECTIONS TO THE STUDENT:

Before attempting this task for mastery, carefully review this checklist. You will be evaluated on the basis of this checklist. When you feel you are ready for evaluation, contact your instructor. You must score at least 5 out of 5 points, or achieve a score equivalent to 100% for mastery.

DIRECTIONS TO THE EVALUATOR:

The student will contact you when ready for evaluation. The student must score 5 out of 5 points, or achieve a score equivalent to 100% for mastery.

PERFORMANCE/PRODUCT CHECKLIST

B 1

CRITICAL ITEMS	ITEMS TO BE OBSERVED OR CHECKED	RATING YES	RATING NO
1.	Grid produced on screen	---	---
2.	Activated grip snap mode	---	---
3.	Activated invisible grid mode	---	---
4.	Grid scale was changed	---	---
5.	Student worked alone	---	---
	TOTAL POINTS EARNED	------	
	POINTS NEEDED FOR MASTERY	---5--	

EXAM

Version 1

Task B 1

NAME ______________________________

DIRECTIONS:

THE PURPOSE OF THIS EXAM IS TO DETERMINE WHETHER OR NOT YOU HAVE UNDERSTOOD THE INFORMATION ON HOW TO SET UP A TWO DIMENSIONAL GRID SYSTEM.

Answer each of the questions below by marking T for true or F for false. Place the letter associated with that choice on the numbered blank space on your ANSWER SHEET. DO NOT WRITE ON THIS TEST! To master this exam, you must answer 9 out of 9 items correctly, or achieve a score equivalent to 100%.

1. A grid system can be used in CAD.

   A. true
   B. false

2. The grid is normally produced on the final hard copy.

   A. true
   B. false

3. The grid system is used for drawing only horizontal and vertical lines.

   A. true
   B. false

4. CAD units have invisible grids.

   A. true
   B. false

5. CAD units need grid systems for dimensioning.

   A. true
   B. false

6. A grid system is required to produce the drawing.

   A. true
   B. false

EXAM B1, Version 1 (continued)

7. The grid mode is not found on the menu.

   A. true
   B. false

8. All systems have a grid function.

   A. true
   B. false

9. The grid system can be used for drawing inclined lines.

   A. true
   B. false

EXAM

Version 2

Task B 1

Name ______________________________

DIRECTIONS:

THE PURPOSE OF THIS EXAM IS TO DETERMINE WHETHER OR NOT YOU HAVE UNDERSTOOD THE INFORMATION ON HOW TO SET UP A TWO DIMENSIONAL GRID SYSTEM.

Answer each of the questions below by marking T for true or F for false. Place the letter associated with that choice on the numbered blank space on your ANSWER SHEET. DO NOT WRITE ON THIS TEST! To master this exam, you must answer 9 out of 9 items correctly, or achieve a score equivalent to 100%.

T F 1. All systems have a visible grid unit.

T F 2. A grid system is used in drafting.

T F 3. A grid system is required to produce the drawing.

T F 4. The grid system is used for drawing only horizontal and vertical lines.

T F 5. CAD units need grid systems for dimensioning.

T F 6. The grid system can be used for drawing inclined lines.

T F 7. The grid mode is not found on the menu.

T F 8. CAD units have invisible grids.

T F 9. The grid is produced on the final hard copy.

STUDENT LEARNING GUIDE

TASK B 2

CREATE A HARD COPY USING A PRINTER AND/OR A PLOTTER

PURPOSE: One of the primary uses of a printer or plotter is to produce a hard copy of a drawing that can be used as a quick check, final product in the shop, or on the job site. You should be familiar with the operation of the printer and plotter in order to determine the most effective use of each process.

OBJECTIVE: Given a CAD system, printer and/or plotter, and drawing problem, CREATE A HARD COPY USING A PRINTER AND/OR PLOTTER. To master this task, you must score 6 out of 6 points on a performance checklist, or achieve a score equivalent to 100%.

LEARNING STEPS

B 2

READ: Information Sheet B 2.1, "Create a Hard Copy from a Printer."

COMPLETE: Activity Sheet B 2.2, "Create a Hard Copy from a Printer," to list specific procedures for your equipment.

READ: Information Sheet B 2.3, "Create a Hard Copy from a Plotter."

COMPLETE: Activity Sheet B 2.4, "Create a Hard Copy from a Plotter," to list the specific procedure for your plotter.

REVIEW: Activity Sheets B 2.2 and B 2.4. Contact your instructor.

COMPLETE: Performance/Product Checklist B 2, "Create a Hard Copy Using a Printer and/or Plotter." Contact your instructor.

INFORMATION SHEET

B 2.1

Create a Hard Copy from a Printer

A hard copy from a printer duplicates the CRT display quickly and conveniently. The primary advantage of this technique is speed. It produces output faster, and less expensive than pen plotting. Complex graphic screen displays may be copied by the touch of a button or a command entry. This includes any combination of graphics and non-graphic (text) display. The entire process requires a few seconds. The copy, however, does not approach the level of quality produced by the pen plotter. Thus, it is used primarily for preliminary check points rather than final copy. It is useful for a quick preview at various intermediate steps of a design project.

Popular methods of generating hard copies are the dot matrix, laser, electrostatic thermal, and the ink jet process printers.

Refer to your Operator's Manual for specific instructions on obtaining a hard copy from a printer.

ACTIVITY SHEET

B 2.2

Create a Hard Copy from a Printer

1. Using your Operator's Manual, list the procedure(s) necessary to obtain a hard copy from a printer.

2. What is the brand name and model number of the printer you are using?

INFORMATION SHEET

B 2.3

Create a Hard Copy from a Plotter

The hard copy drawing produced by a CAD system is equivalent to the hand produced drawing done by a drafter. An accurate hand copy drawing is usually produced on a CAD system, using a plotter. A plotter is an electromechanical output device that "draws" lines (or letters and numbers) on most drawing media. The digital plotter is capable of moving a pen in two dimensions (x and y coordinates) across the paper, vellum, or film. Plotters are classified according to types (drum, microgrip, or flatbed) and according to the size of drawing media they can accept (A size - 8 1/2 x 11, B size - 11 x 17, etc.). A plotter normally uses some type of inking device (usually a pen), and can usually hold one, two, six, or eight pens of differing sizes and colors.

Refer to your Operator's Manual for the correct procedures and commands necessary to plot a drawing from the system.

ACTIVITY SHEET

B 2.4

Create a Hard Copy from a Plotter

1. Using your Operator's Manual, list the procedures necessary to plot a drawing.

2. What is the brand name and model name of the plotter you are using?

TASK: CREATE A HARD COPY USING A PRINTER AND/OR A PLOTTER

TASK # B 2

PERFORMANCE/PRODUCT CHECKLIST

STUDENT'S NAME ______________________ PERFORMANCE ATTEMPT 1 2 3 4

EVALUATOR'S NAME ____________________ DATE OF ATTEMPT ___________

OBJECTIVE:

Given a CAD system, printer, plotter, and drawing problem CREATE A HARD COPY USING A PRINTER AND/OR A PLOTTER.

DIRECTIONS TO THE STUDENT:

Before attempting this task for mastery, carefully review this checklist. You will be evaluated on the basis of this checklist. When you feel you are ready for evluation, contact your instructor. You must score at least 6 out of 6 points, or achieve a score equivalent to 100% for mastery.

DIRECTIONS TO THE EVALUATOR:

The student will contact you when ready for evaluation. The student must score 6 out of 6 points, or achieve a score equivalent to 100% for mastery.

PERFORMANCE/PRODUCT CHECKLIST

B 2

CRITICAL ITEMS	ITEMS TO BE OBSERVED OR CHECKED	RATING YES/NO
I.	**PRINTER**	
A.	Made a correct drawing	--- ---
B.	Followed proper procedure to make the print	--- ---
C.	Obtained a printed hard copy	--- ---
II.	**PLOTTER**	
D.	Made a correct drawing	--- ---
E.	Followed proper procedure to make the plot	--- ---
F.	Obtained a plotted hard copy	--- ---
	TOTAL POINTS POSSIBLE	-------
	POINTS NEEDED FOR MASTERY	---6---

STUDENT LEARNING GUIDE

TASK B 3

CREATE, MANIPULATE, AND EDIT TEXT

PURPOSE: Because of the use of notations and lettering found on industrial drawings, you must become familiar with and use the commands necessary for creation and placement of text on drawings.

OBJECTIVE: Given a CAD system and software, you will CREATE, MANIPULATE AND EDIT TEXT. To master this task, you must score 13 out of 13 points on a performance checklist, or achieve a score equivalent to 100%.

LEARNING STEPS

B 3

READ: Information Sheet B 3.1, "Create, Manipulate and Edit Text," and Operator's Manual on creating, manipulating, and editing text.

COMPLETE: Activity Sheet B 3.2, "Creating, Manipulating and Editing Text," for a self-check on creating, manipulating, and editing text.

COMPLETE: Performance/Product Checklist B 3, "Create, Manipulate and Edit Text," to demonstrate mastery of this task. Contact your instructor.

INFORMATION SHEET

B 3.1

Create, Manipulate, and Edit Text

CREATING TEXT

The term "TEXT" in CAD refers to any and all lettering that appears on a drawing. A CAD system may contain one or more "FONTS," or styles of lettering. Some systems allow the user to create an individualized style of lettering. Most CAD systems have a lettering style that is automatically recalled and inserted on a drawing.

MANIPULATING TEXT

Once text has been placed on a drawing, the operator has the ability to change the size, location, or angle of text. These operations are called manipulating text.

EDITING TEXT

"Editing text" refers to any correction, deletion, or change in wording of text on your drawing.

Refer to the Operator's Manual on creating, manipulating, and editing text.

ACTIVITY SHEET

B 3.2

Creating, Manipulating, and Editing Text

CREATE TEXT

1. Using the Operator's Manual, list the commands necessary to insert and locate text.

2. Insert your name using instructor's specified size.

MANIPULATE TEXT

1. Using the Operator's Manual, list your CAD system's default parameter values for text height, width, slant, etc.

2. Using your CAD system and necessary commands, change the text default parameter values.

3. Using the existing text (your name), rotate text to instructor's specified positions.

EDIT TEXT

1. Using the Operator's Manual, list the commands necessary to edit text.

2. Edit your text (see instructor).

TASK: CREATE, MANIPULATE AND EDIT TEXT

TASK #: B 3

PERFORMANCE/PRODUCT CHECKLIST

STUDENT'S NAME ______________________ PERFORMANCE ATTEMPT 1 2 3 4

EVALUATOR'S NAME ____________________ DATE OF ATTEMPT __________

OBJECTIVE:

Given a CAD system and software, you will CREATE AND MANIPULATE TEXT.

DIRECTIONS TO THE STUDENT:

Before attempting this task for mastery, carefully review this checklist. You will be evaluated on the basis of this checklist. When you feel you are ready for evaluation, contact your instructor. You must score at least 13 out of 13 points, or achieve a score equivalent to 100% for mastery.

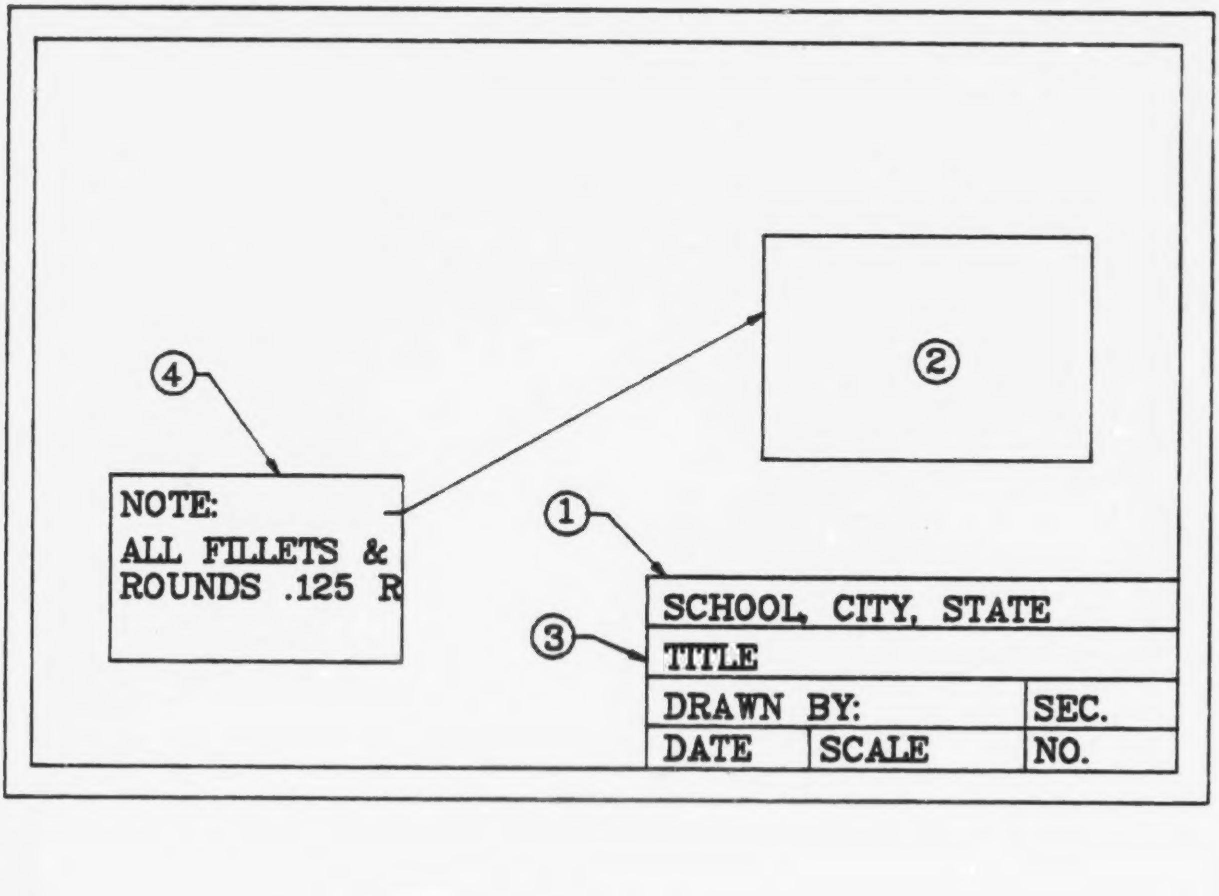
DIRECTIONS TO THE EVALUATOR:

The student will contact you when ready for evaluation. The student must score 13 out of 13 points, or achieve a score equivalent to 100% for mastery.

DIRECTIONS FOR CHECKLIST B 3

First, develop a title block from instructions given to you by the instructor. Place general information in the title block and store in memory for future use.

In the drawing area, place several notes supplied to you by the instructor. Manipulate these notes as the instructor tells you. Change the default parameter values and insert new text. Finally, edit all text, both in the drawing and in the title block.


④
②
NOTE:
ALL FILLETS &
ROUNDS .125 R
①
③
SCHOOL, CITY, STATE
TITLE
DRAWN BY:
SEC.
DATE
SCALE
NO.

PERFORMANCE/PRODUCT CHECKLIST

B 3

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
1.	Turned power on	--- ---
2.	Inserted disk properly	--- ---
3.	Logged on	--- ---
4.	Booted system correctly	--- ---
5.	Inserted text	--- ---
6.	Changed default parameter values for text	--- ---
7.	Inserted text, using new default parameter values	--- ---
8.	Manipulated text, using necessary commands	--- ---
9.	Edited text	--- ---
10.	Logged Off	--- ---
11.	Removed and stored disks correctly	--- ---
12.	Turned power off	--- ---
13.	Student worked alone	--- ---

TOTAL POINTS EARNED ------

POINTS NEEDED FOR MASTERY --13--

STUDENT LEARNING GUIDE

TASK B 4

SELECT APPROPRIATE GEOMETRY TO CREATE AND EDIT LINES, CIRCLES, AND ARCS

PURPOSE:	All drawings are made up of geometric entities including lines, circles, and arcs. Every CAD operator should be familiar with their properties and the commands necessary to create and edit them using a CAD system.
OBJECTIVE:	Given a CAD system, you will SELECT APPROPRIATE GEOMETRY TO CREATE AND EDIT LINES, CIRCLES, AND ARCS. To master this task, you must score 18 out of 18 points on a performance checklist, or achieve a score equivalent to 100%.

LEARNING STEPS

B 4

READ:	Information Sheet B 4.1, "Construction of Lines."
READ:	Operator's Manual dealing with specific commands on construction of lines.
COMPLETE:	Activity Sheet B 4.2, "Constructing Lines to Form Geometric Shapes," to practice constructing lines.
READ:	Information Sheet B 4.3, "Construction of Circles," for procedures used to construct circles.
READ:	Operator's Manual dealing with specific commands on construction of circles.
COMPLETE:	Activity Sheet B 4.4, "Constructing Circles" to practice constructing circles.
READ:	Information Sheet B 4.5, "Construction of Arcs," for procedures used to construct arcs.
READ:	Operator's Manual dealing with construction of arcs.
COMPLETE:	Activity Sheet B 4.6, "Construction of Arcs," to practice constructing arcs.
READ:	Information Sheet B 4.7, "Edit and Delete Commands," to identify the procedure used to edit and delete drawings.
READ:	Operator's Manual on edit and delete commands.
COMPLETE:	Activity Sheet B 4.8, "Edit and Delete Commands," to practice using these commands.
COMPLETE:	Product Checklist B 4 to demonstrate mastery of this task. Contact your instructor.

INFORMATION SHEET

B 4.1

Construction of Lines

In a CAD system, one must be able to input the proper commands and functions in sequence to create geometric forms. You should read the Operator's Manual to understand the proper command sequence for your system.

LINES:

Two methods of constructing lines on a drawing are to input the information by using a keyboard or by using a digitizer. The following is a general procedure for inputting lines:

1. Use proper commands.
2. Move the cursor to establish one of the end points.
3. Move cursor to the other end point. Input this point. The result will be a line connecting the two given points.

CAD systems also have commands which allow the operator to change line style and density (alphabet of lines). The choice of line style varies from system to system.

Consult your Operator's Manual for specific procedures dealing with the construction and modification of lines.

ACTIVITY SHEET

B 4.2

Constructing Lines to Form Geometric Shapes

DIRECTIONS: Refer to your Operator's Manual on the procedure to construct a geometric shape using the line function.

1. List the procedure(s) in constructing geometric shapes using the line function.

2. List and sketch the line styles available on your CAD system.

3. Using a one inch grid, construct the template as shown in Figure 1.

4. Call instructor for visual check of drawing and check of procedures.

5. Draw one horizontal line of each line style available on your system.

6. Call instructor for visual check of drawing and check of procedures.

ACTIVITY SHEET B 4.2 (continued)

7. Using a half inch grid, divide the screen into 4 equal areas and construct the polygons as shown in Figure 2. See instructor for exact size dimensions.

8. Call instructor for visual check of drawing and check of procedures.

9. If satisfactorily completed, proceed to Information Sheet B 4.3.

Figure 1

B 4

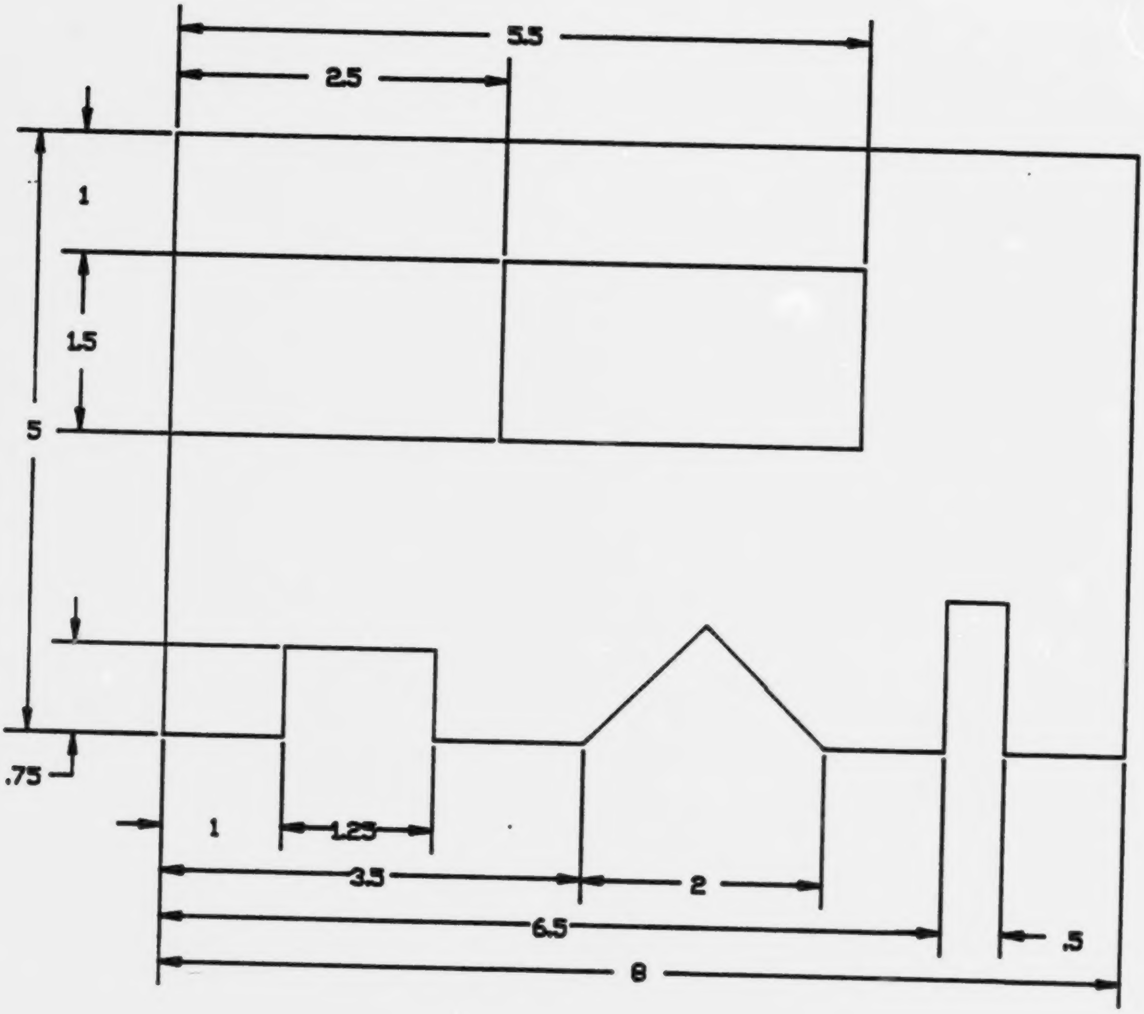
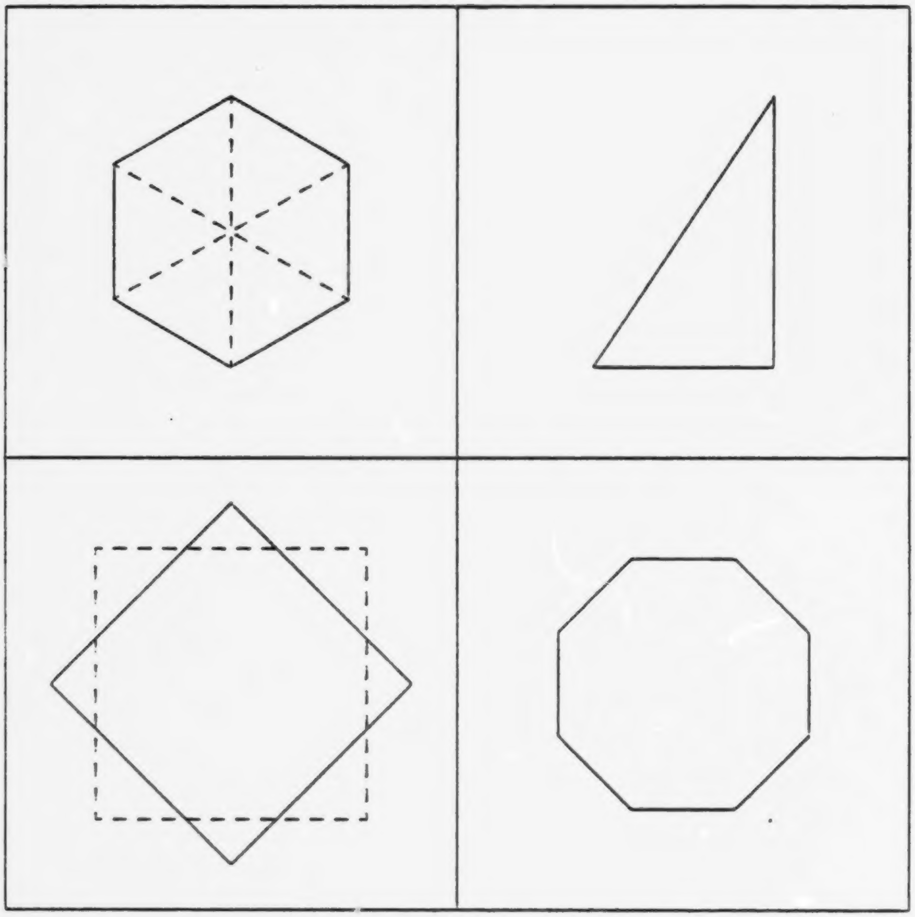

5.5
2.5
1
1.5
5
.75
1
1.25
3.5
2
6.5
.5
8

Figure 2

B 4.2 (continued)



INFORMATION SHEET

B 4.3

Construction of Circles

There are several methods of constructing circles. These include center point/radius, diameter, and three given points. The following is a general procedure for constructing circles in each of these methods:

Center point/radius method

1. Use the proper command.
2. Locate the center point and input this point.
3. Input the radius by using the keyboard or digitizer tablet.
   The result will be a circle with the given center point and radius.

Diameter

1. Use the proper command.
2. Locate the first point on the circle's diameter, and input by using the keyboard or digitizer tablet.
3. Locate the next point on the circle's diameter, and input it by using the keyboard or digitizer tablet.
   The result will be a circle going through 2 points on the diameter.

Three given points method

1. Use the proper command.
2. Locate the three points which are to be included in the circle and the input.
   The result will be a circle going through all three points.

Consult your Operator's Manual for specific procedures dealing with construction of circles.

ACTIVITY SHEET

B 4.4

Constructing Circles

DIRECTIONS: Refer to your Operator's Manual on the procedure to construct circles.

1. Read the procedure for constructing circles using the circle function. List the correct sequence for constructing circles on drawing of commands.

2. Construct a 1.75 inch radius circle; include correctly placed lines.

3. Construct a 2.5 inch diameter circle; include correctly placed center lines.

4. Construct a circle through three given points.

5. Call instructor for visual check of drawing and check of procedure.

6. If satisfactorily completed, go on to Information Sheet B 4.5.

INFORMATION SHEET

B 4.5

Construction of Arcs

There are several methods of constructing arcs on a CAD system. Included among them are the center point, start point, end point, and the three point method.

The following is a general procedure for creating arcs:

Center point, start point, end point

1. Be aware of the direction in which your arc will be drawn.
2. Locate the center point of the arc and input.
3. Locate the start point of the arc and input.
4. Locate the end point of the arc and input.

Three arc points

1. Locate three points which are to be located on the arc and input those points, following procedures in Operator's Manual.

Consult your Operator's Manual for specific procedures dealing with construction of arcs.

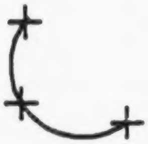
ACTIVITY SHEET

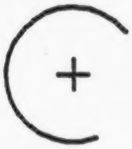
B 4.6

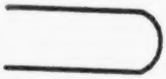
Construction of Arcs

DIRECTIONS: Read your Operator's Manual on the procedure to construct arcs.

1. Construct the ARCS shown in examples:







2. Call instructor for visual check of drawing and procedure.
3. If satisfactorily completed, go on to Activity Sheet B 4.7.

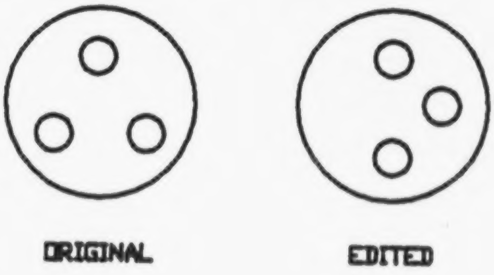
INFORMATION SHEET

B 4.7

Edit and Delete Commands

EDIT:

Editing is a type of manipulation which allows you to make revisions or modifications to an existing drawing.



The general procedure used to edit a drawing is as follows:

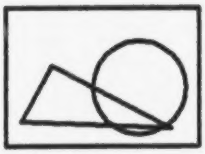
1. Select the appropriate command: MODIFY, EDIT, REVISE.
2. Specify entity to be modified.
3. Make desired changes to image.
4. Press END or RETURN.
5. Enter Redraw or Repaint command.

Consult your Operator's Manual for specific command procedures.

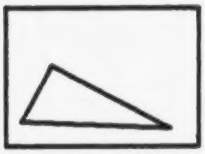
INFORMATION SHEET B 4.7 (continued)

DELETE:

The delete command is used for removing entities from a drawing. Entities may be deleted by identifying each singular entity, grouping of entities, or by deleting the entire screen.



ORIGINAL



DELETED CIRCLE

The general procedure used to delete an entity from a screen is as follows:

1. Select appropriate command; i.e., DELETE, REMOVE, ERASE.
2. Specify the entity to be deleted.
   Example:
      Delete All
      Delete Line
      Delete Last Entry
3. Press the proper button or return to complete procedure.

NOTE: Consult your Operator's Manual for specific commands.

ACTIVITY SHEET

B 4.8

Edit and Delete Commands

1. Refer to Information Sheet B 4.7 dealing with editing a drawing.

   A. Construct an object similar to the original in B 4.7.

   B. Edit the original so that it appears as the "edited" problem.

2. Refer to Information Sheet B 4.7 dealing with deleting an entity. Consult with your instructor before deleting any of the problems below.

   A. Construct a line on the screen.

   B. Delete this line.

   C. Construct an arc on the screen.

   D. Delete this arc.

   E. Construct the original diagram in B 4.7.

   F. Delete the circle to leave just the triangle.

   G. Finally, delete the triangle to leave an empty screen.

TASK: SELECT APPROPRIATE GEOMETRY TO CREATE AND EDIT LINES, CURVES AND ARCS

TASK # B 4

PERFORMANCE/PRODUCT CHECKLIST

STUDENT'S NAME ______________________ PERFORMANCE ATTEMPT 1 2 3 4

EVALUATOR'S NAME ____________________ DATE OF ATTEMPT __________

OBJECTIVE:

Given a CAD system, you will SELECT APPROPRIATE GEOMETRY TO CREATE LINES, CURVES, AND ARCS.

DIRECTIONS TO THE STUDENT:

Before attempting this task for mastery, carefully review this checklist. You will be evaluated on the basis of this checklist. When you feel you are ready for evaluation, contact your instructor. You must score at least 18 out of 18 points, or achieve a score equivalent to 100% for mastery.

DIRECTIONS TO THE EVALUATOR:

The student will contact you when ready for evaluation. The student must score 18 out of 18 points, or achieve a score equivalent to 100% for mastery.

CHECKLIST

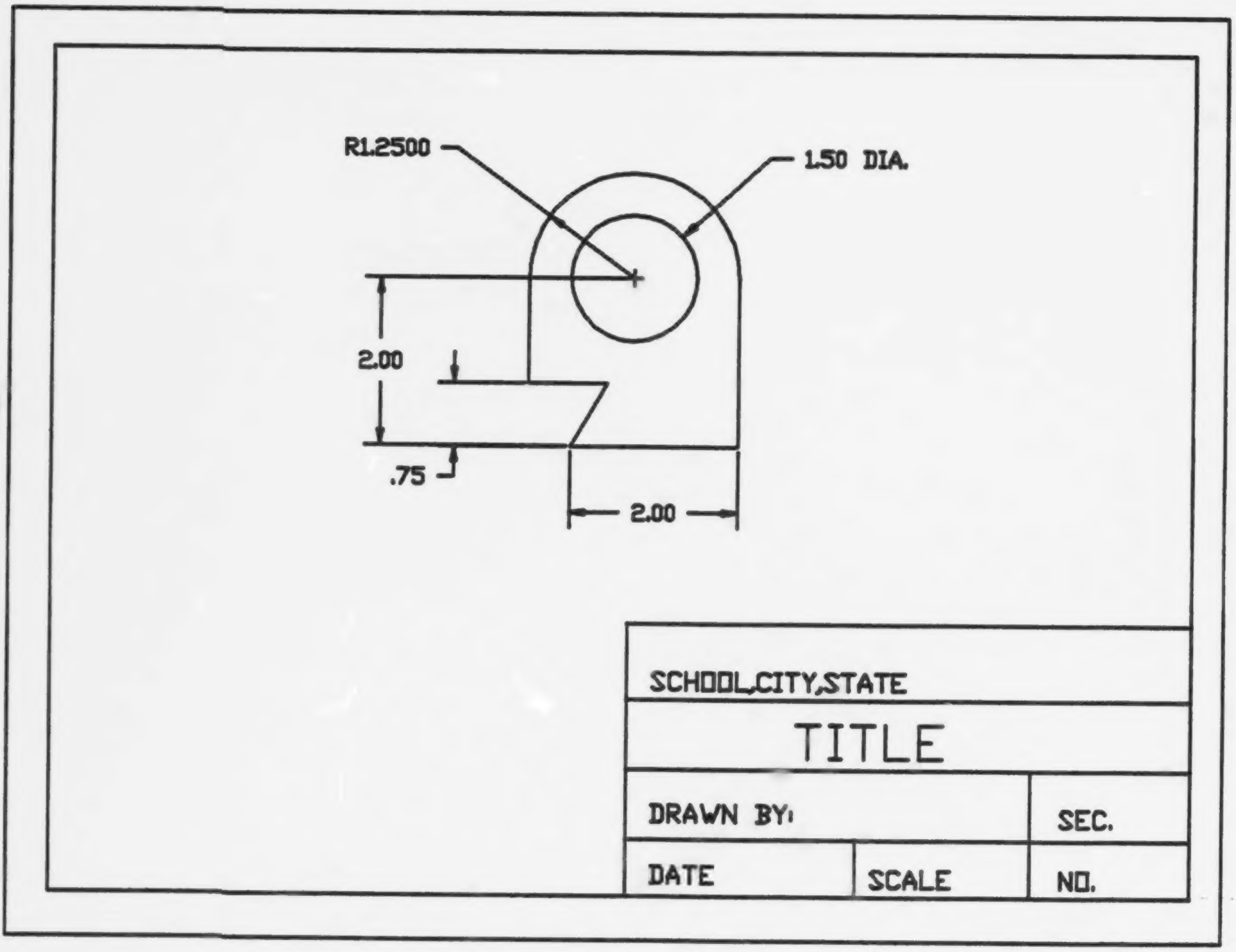
DIRECTIONS: Complete the shim in Figure 3 B 4 and follow the steps below.

1. Add borderline
2. Add title block
3. Include NAME: your name
   TITLE: part name (shim)
   SCALE: 1=1
   DATE: today's date
4. Complete problem (include centerlines)
5. Save problem
6. Produce hard copy
7. Do not include dimensions
8. Have your instructor check your work

Figure 3

B 4

SHIM


R1.2500
1.50 DIA.
2.00
.75
2.00
SCHOOL,CITY,STATE
TITLE
DRAWN BY:
SEC.
DATE
SCALE
NO.

PERFORMANCE/PRODUCT CHECKLIST

B 4

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
1.	Turned on power	--- ---
2.	Used proper disk	--- ---
3.	Logged on	--- ---
4.	Retrieved stored drawings	--- ---
5.	Constructed borderline	--- ---
6.	Constructed and completed title block	--- ---
7.	Located and constructed center lines	--- ---
8.	Located and constructed arc to proper size	--- ---
9.	Located and constructed circle to proper size	--- ---
10.	Constructed vertical lines to the given length originating from arc	--- ---
11.	Constructed horizontal line to the given dimensions	--- ---
12.	Constructed angle to the given dimensions	--- ---
13.	Produced specified hard copy	--- ---
14.	Stored drawing	--- ---
15.	Logged off	--- ---
16.	Returned all disks to proper storage area	--- ---
17.	Turned off power	--- ---
18.	Student worked alone	--- ---

TOTAL POINTS EARNED ------

POINTS NEEDED FOR MASTERY __18__

STUDENT LEARNING GUIDE

TASK B 5

SELECT APPROPRIATE GEOMETRY TO CREATE CURVES, TANGENTS, FILLETS, CHAMFERS, AND BEVELS

PURPOSE: As the CAD operator progresses to more intricate problems, the ability to create tangents, curves, and chamfers becomes a necessary skill. Any object, no matter how complex, can be broken down to its basic geometric forms and reproduced by the skilled CAD operator.

OBJECTIVE: Given a CAD system, you will SELECT APPROPRIATE GEOMETRY TO CREATE CURVES, TANGENTS, FILLETS, CHAMFERS, AND BEVELS. To master this task, you must score 17 out of 17 points on a performance checklist, or achieve a score equivalent to 100%.

LEARNING STEPS

B 5

READ: Information Sheet B 5.1, "Construction of Curves/Splines."

READ: Operator's Manual dealing with the construction of curves/splines.

COMPLETE: Activity Sheet B 5.2, "Construction of a Curve/Spline," to practice constructing curves/splines.

READ: Information Sheet B 5.3, "Create Tangents with Lines and Arcs," to identify the procedure to construct tangents.

READ: Operator's Manual on creating tangents and arcs.

COMPLETE: Activity Sheet B 5.4, "Creating Tangents," to practice creating tangents.

READ: Information Sheet B 5.5, "Creating Fillets, Rounds, Chamfers, and Bevels," for the procedure to create them.

READ: Operator's Manual on constructing fillets, rounds, chamfers, and bevels."

COMPLETE: Activity Sheet B 5.6, "Create Fillets, Rounds, Chamfers and Bevels," to practice constructing fillets, rounds, chamfers, and bevels.

COMPLETE: Product Checklist B 5 to demonstrate mastery of this task. Contact your instructor.

INFORMATION SHEET

B 5.1

Construction of Curves/Splines

Curves are used in constructing many types of objects. The following is a general procedure to construct curves on a CAD system:

1. Use the proper command.
2. Locate several points on the curve and input these points.

Consult your Operator's Manual for specific procedures dealing with the construction of curves.

ACTIVITY SHEET

B 5.2

Construction of a Curve/Spine

DIRECTIONS: Refer to your Operator's Manual on the procedures to construct a curve.

NOTE: An arc has a specific radius whereas a curve is generated through a series of points with no constant radii.

1. List the procedure in your Operator's Manual for constructing a curved line.

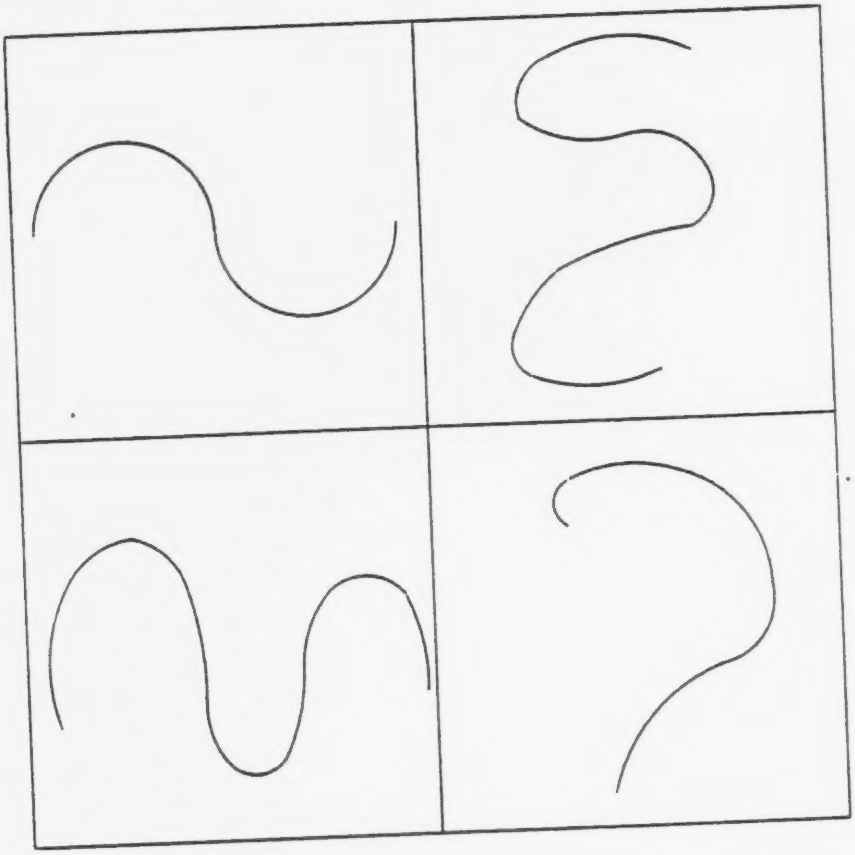
2. Construct four curves as close as possible to the examples given. (See Figure 1.)

3. Call instructor for visual check of drawing and check off procedure.

4. If satisfactorily completed, go on to Information Sheet B 5.3.

Figure 1

B 5.2 (continued)



INFORMATION SHEET

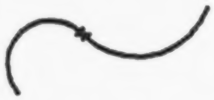
B 5.3

CREATE TANGENTS WITH LINES AND ARCS

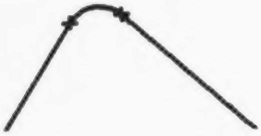
In the area of design and drafting, a tangent is a line, arc, curve, circle, surface, etc., that touches another object at one point only, as illustrated in the examples below.

Below are examples of tangents:

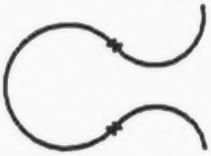
A. A tangent point between two curved lines



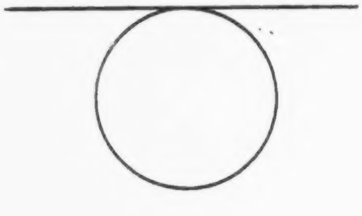
B. Tangent points between two lines connected by an arc



C. An arc tangent between two arcs



D. A line tangent to a circle



INFORMATION SHEET B 5.3 (continued)

The general procedure used to construct tangents is either the line, arc, or circle functions from your command menu.

In example A: Given an arc, create a tangent arc.
1. Select arc function.
2. Locate three points which are to be located on the arc with one end-point tangent.
3. Input.

The result will be an arc tangent to an arc.

In example B: Given two lines, construct a tangent arc.
1. Select arc function.
2. Locate end point of one line and digitize.
3. Locate end point of second line and digitize.
4. Locate a radius and digitize.

The result will be an arc tangent to two lines.

In example C: Given two arcs, construct a tangent arc.
1. Follow same procedure as in example B.

In example D: Given a circle, create a tangent line.
1. Select line function.
2. Digitize point on circle.
3. Digitize end point of line.

The result will be a line tangent to a circle.

Note: Consult your Operator's Manual on the specific way to construct tangents with lines and arcs.

ACTIVITY SHEET

B 5.4

Creating Tangents

DIRECTIONS: Refer to your Operator's Manual on creating lines and tangent arcs.

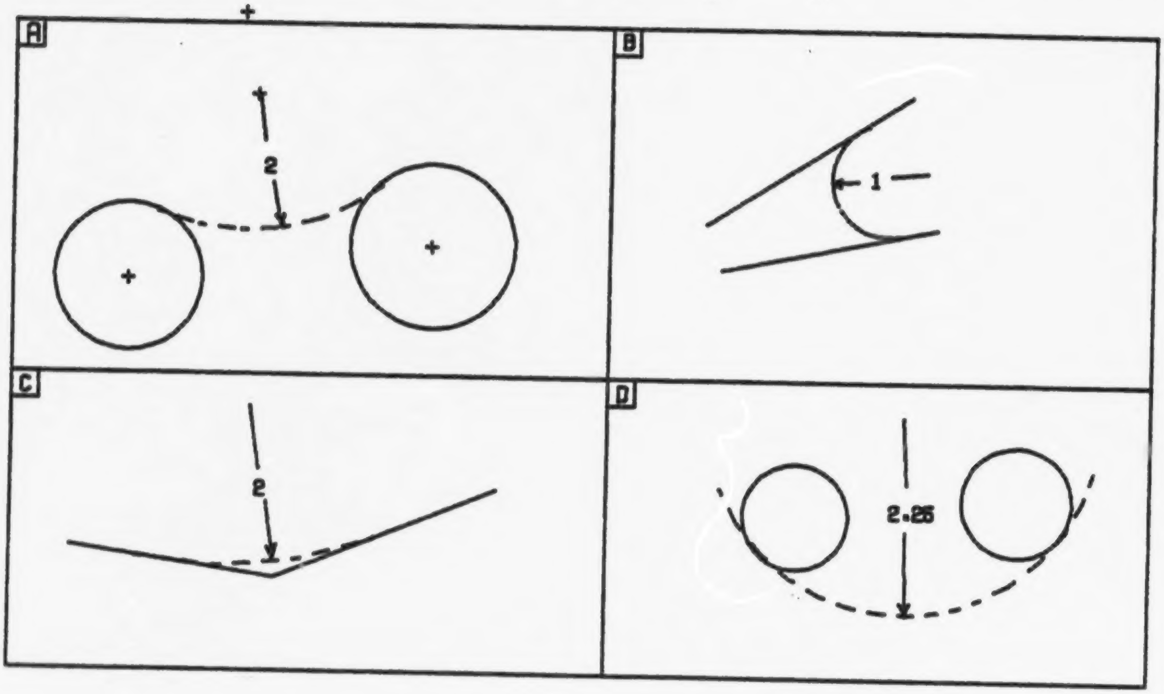
1. Read the procedure on constructing tangent lines and arcs. List in correct sequence the commands to construct tangent lines and arcs.

2. Construct line or arc indicated by dashed lines, on Problems "A" through "H."

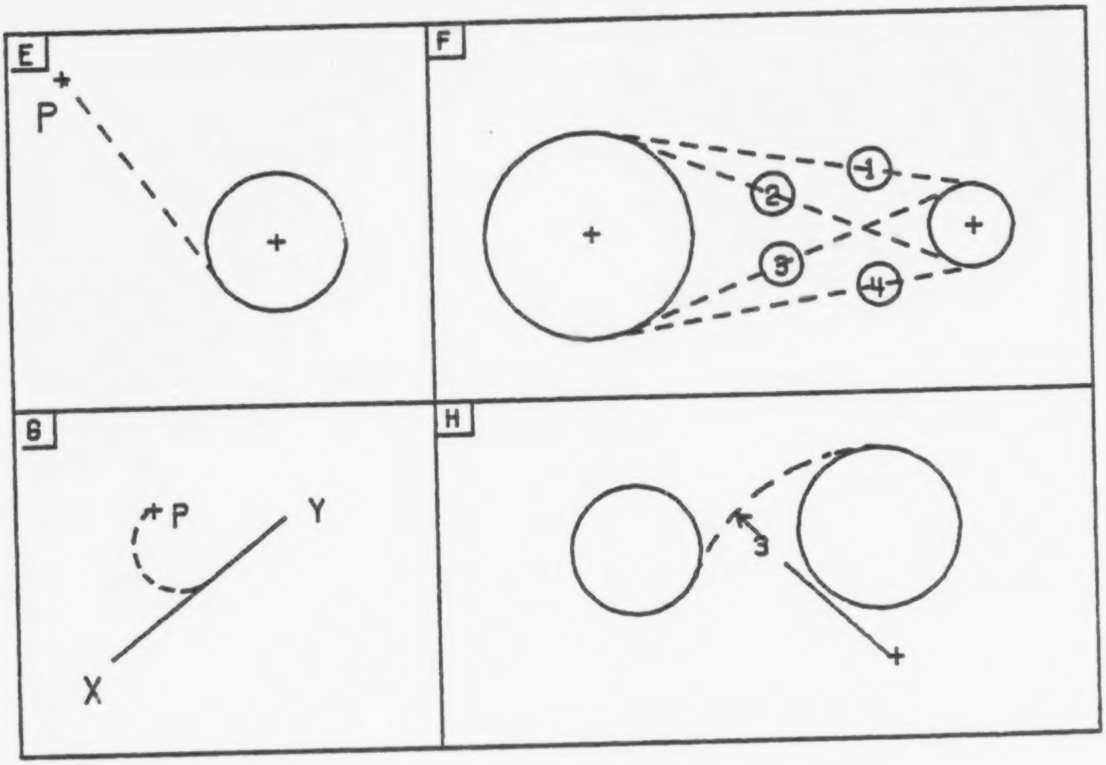
3. Call instructor for visual check of drawings and check procedures for A through D and E through H.

4. If satisfactorily completed, proceed to Information Sheet B 5.5.

Problems B 5.4


A
2
B
1
C
2
D
2.25

Problems B 5.4 (continued)

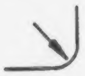

E
P
F
1
2
3
4
G
P
Y
X
H
3

INFORMATION SHEET

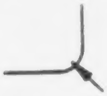
B 5.5

Creating Fillets, Rounds, Chamfers, and Bevels

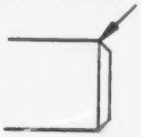
FILLET - An inside curve



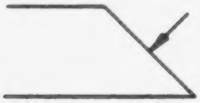
ROUND - An outside curve



CHAMFER - A narrow inclined surface along the intersection of two surfaces.



BEVEL - A flat inclined surface connecting two surfaces.



FILLETS AND ROUNDS - The procedure for constructing fillets and rounds is very similar to that for constructing tangents, a process which was previously discussed in this task. The following is a general procedure for constructing fillets and rounds.

1. Construct the two lines to which the fillet will be connected.
2. Use the proper command.
3. Locate end points of lines and input.
4. Input the radius of fillet.
   The result will be a fillet connecting the two points with the given radius.

Consult your Operator's Manual for specific procedures dealing with constructing fillets and rounds.

ACTIVITY SHEET

B 5.6

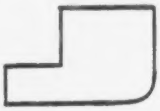
Create Fillets, Rounds, Chamfers, and Bevels

DIRECTIONS: Refer to your Operator's Manual on the procedure to construct fillets, rounds, chamfers, and bevels.

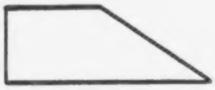
1. List the procedure for constructing fillets and chamfers.

2. Identify the following by using the terms fillet, round, bevel, and chamfer.

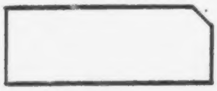
A. ___________________



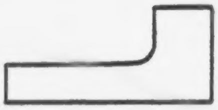
B. ___________________



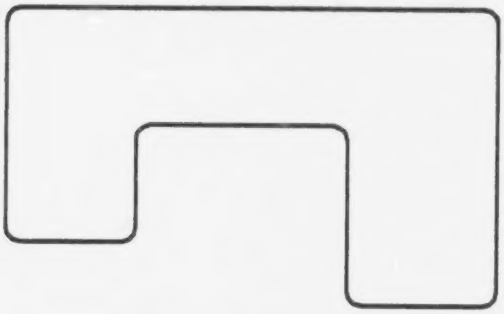
C. ___________________



D. ___________________

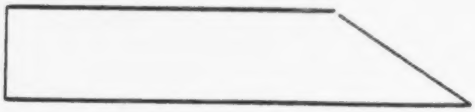


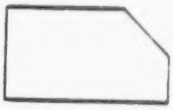
3. Construct the geometric shape shown below.
NOTE: All fillets and rounds .250R.

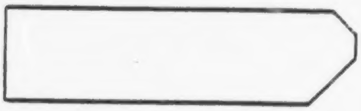


ACTIVITY SHEET B 5.6 (continued)

4. Construct the geometric shapes shown below.







5. Call instructor for visual check of drawing and check of procedures.

6. If satisfactorily completed, proceed to Performance/Product Checklist B 5.

TASK: SELECT APPROPRIATE GEOMETRY TO CREATE CURVES, TANGENTS, FILLETS, CHAMFERS AND BEVELS

TASK # B 5

PERFORMANCE/PRODUCT CHECKLIST

STUDENT'S NAME ____________________ PERFORMANCE ATTEMPT 1 2 3 4

EVALUATOR'S NAME ____________________ DATE OF ATTEMPT __________

OBJECTIVE:

Given a CAD system you will SELECT APPROPRIATE GEOMETRY TO CREATE CURVES, TANGENTS, FILLETS, CHAMFERS, and BEVELS.

DIRECTIONS TO THE STUDENT:

Before attempting this task for mastery, carefully review this checklist. You will be evaluated on the basis of this checklist. When you feel you are ready for evaluation, contact your instructor. You must score at least 17 out of 17 points, or achieve a score equivalent to 100% for mastery.

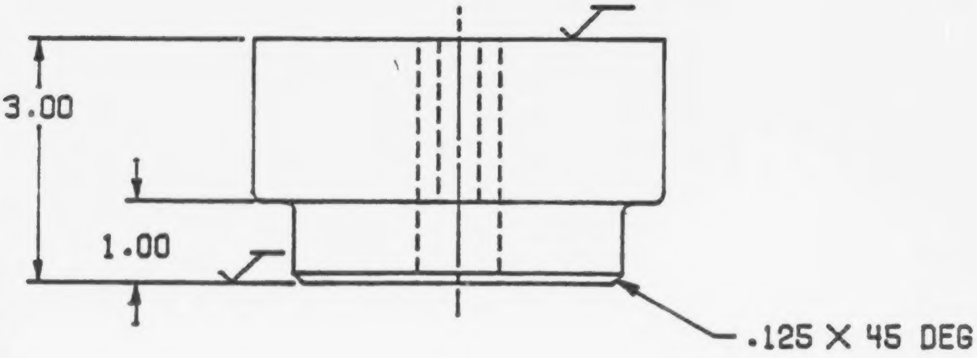
DIRECTIONS TO THE EVALUATOR:

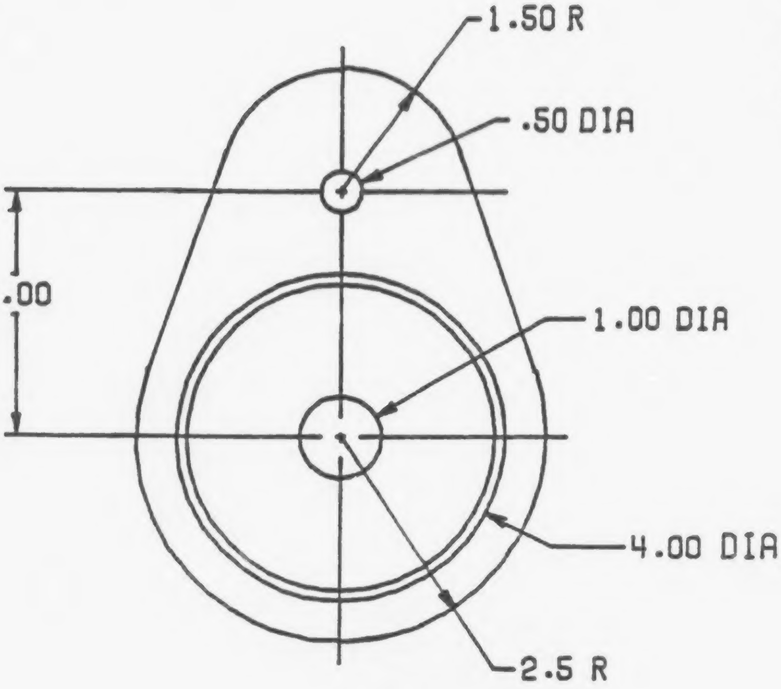
The student will contact you when ready for evaluation. The student must score 17 out of 17 points, or achieve a score equivalent to 100% for mastery.

CHECKLIST PROBLEM B 5

DIRECTIONS:

A. Construct the drawing below.
B. Set up a grid using a scale 1=1.
C. Student must complete 10 out of 10 or (100%) on the Product/Performance Checklist.
D. Produce hard copy and turn in.
E. NOTES: Omit dimensions.
All fillets and rounds = 1/8 R.
All chamfers are 1/8 x 45 degrees.


3.00
1.00
.125 X 45 DEG


1.50 R
.50 DIA
3.00
1.00 DIA
4.00 DIA
2.5 R

ALL FILLETS AND ROUNDS .125 UNLESS OTHERWISE SPECIFIED

PERFORMANCE/PRODUCT CHECKLIST

B 5

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
1.	Turned on power	--- ---
2.	Inserted disk	--- ---
3.	Logged/on	--- ---
4.	Vertical and horizontal lines meet to form corners	--- ---
5.	Fillets are tangent	--- ---
6.	Rounds are tangent	--- ---
7.	Hidden lines projected properly	--- ---
8.	Lines are tangent to arcs	--- ---
9.	Center lines located correctly	--- ---
10.	Circles located in proper place and drawn the correct size	--- ---
11.	Grid used properly	--- ---
12.	Drawing looks neat	--- ---
13.	Stored drawing	--- ---
14.	Logged/off	--- ---
15.	Turned power off	--- ---
16.	Returned disks to proper storage area	--- ---
17.	Student worked alone	--- ---
	TOTAL POINTS EARNED	-------
	POINTS NEEDED FOR MASTERY	---17--

STUDENT LEARNING GUIDE

TASK B 6

MANIPULATE GEOMETRIC SHAPES

PURPOSE: Once a geometric shape is displayed on the screen, there is generally a need to manipulate it in some way. To manipulate the geometric shape on a CAD system, you will display more detail and define the drawing for better understanding. It is important for the CAD drafter to zoom in or out, mirror, align, move, copy, rotate, and be familiar with coordinate systems to move geometric shapes. These various manipulations may save the CAD operator time and make the drawing more precise.

OBJECTIVE: Given a CAD system, you will MANIPULATE GEOMETRIC SHAPES. To master this task, you must score 16 out of 16 points on a performance checklist, or achieve a score equivalent to 100%.

LEARNING STEPS

B 6

READ: Information Sheet B 6.1, "Coordinate Systems," for information on coordinate systems.

READ: Operator's Manual on coordinate systems.

COMPLETE: Activity Sheet B 6.2, "Coordinate Systems," for a self-check on coordinate systems.

READ: Information Sheet B 6.3, "Rotation and Zoom," for information on rotation and zoom.

READ: Operator's Manual on rotation and zooming.

COMPLETE: Activity Sheet B 6.4, "Rotation and Zoom," to practice the rotation and zoom commands.

READ: Information Sheet B 6.5, "Mirror and Copy Option," for the procedure on mirroring and copying.

READ: Operator's Manual on copy/repeat and mirror.

COMPLETE: Activity Sheet B 6.6, "Copy and Mirror Option," to practice copying and mirroring objects.

READ: Information Sheet B 6.7, "Aligning and Moving an Object," for the procedure to align and move objects.

READ: Operator's Manual on aligning and moving.

COMPLETE: Activity Sheet B 6.8, "Aligning and Moving Options," to practice aligning and moving objects.

COMPLETE: Performance Checklist B 6 "Manipulate Geometric Shapes," to demonstrate mastery of this task. Contact your instructor.

INFORMATION SHEET

B 6.1

Coordinate Systems

COORDINATES

All points in a 2D CAD system have a specific location according to an X (horizontal) and Y (vertical) axis. The numeric value of these locations relative to the X and Y axis are the coordinates of the points.

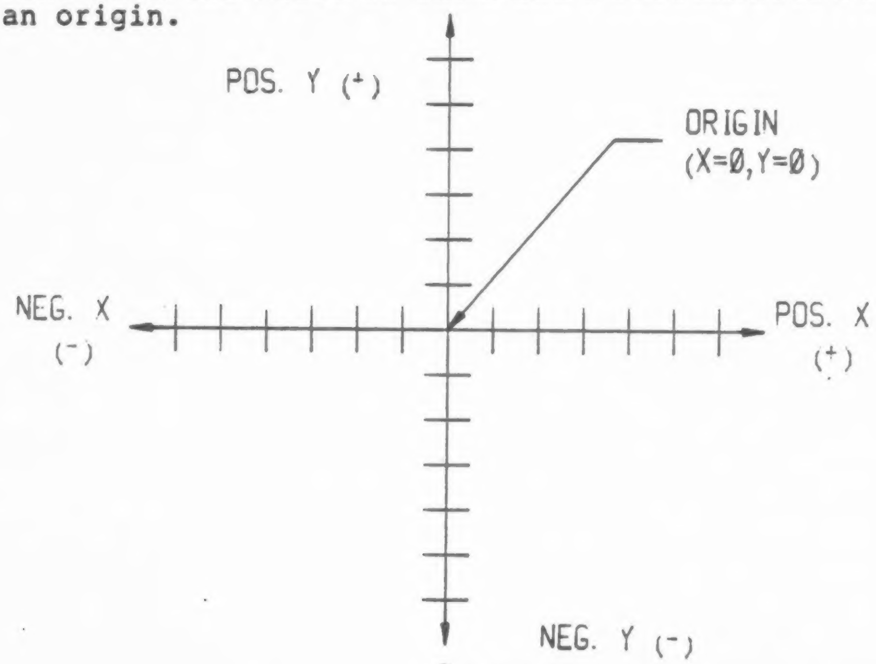
Many terms are used by different CAD systems to identify coordinates. Examples are:

Absolute
Relative
Incremental
Polar
Delta
Cartesian

Many of these terms are synonomous. Most systems use the absolute, incremental, and polar coordinates which we will discuss.

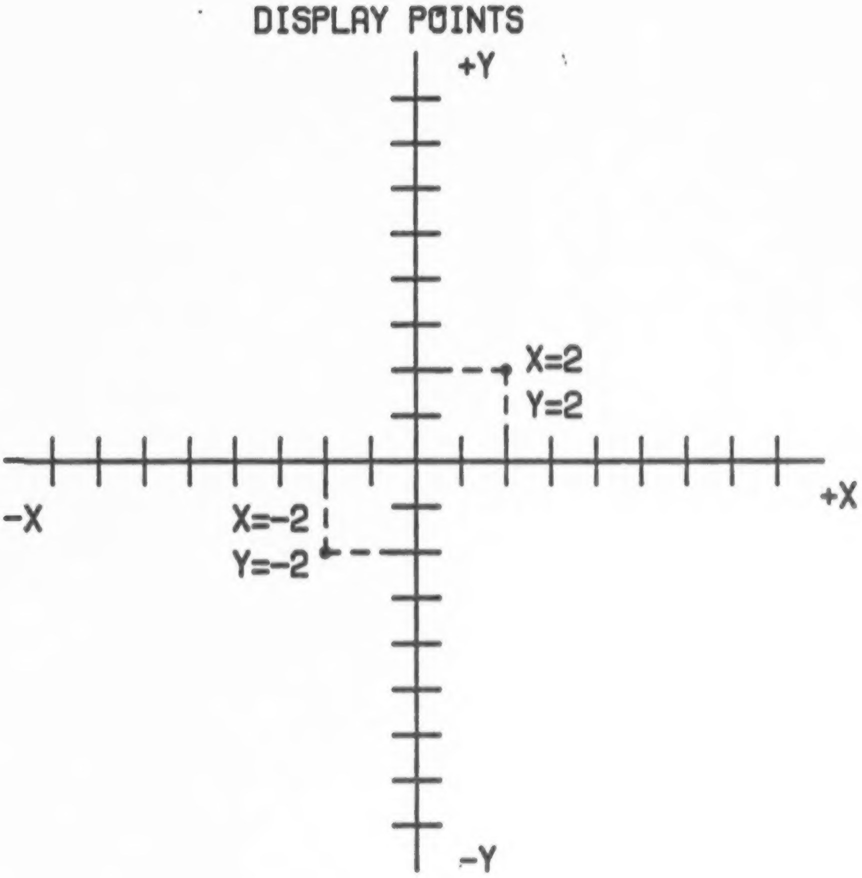
ABSOLUTE COORDINATE

A point with the value of the X and Y coordinates respective to an origin.



INFORMATION SHEET B 6.1 (continued)

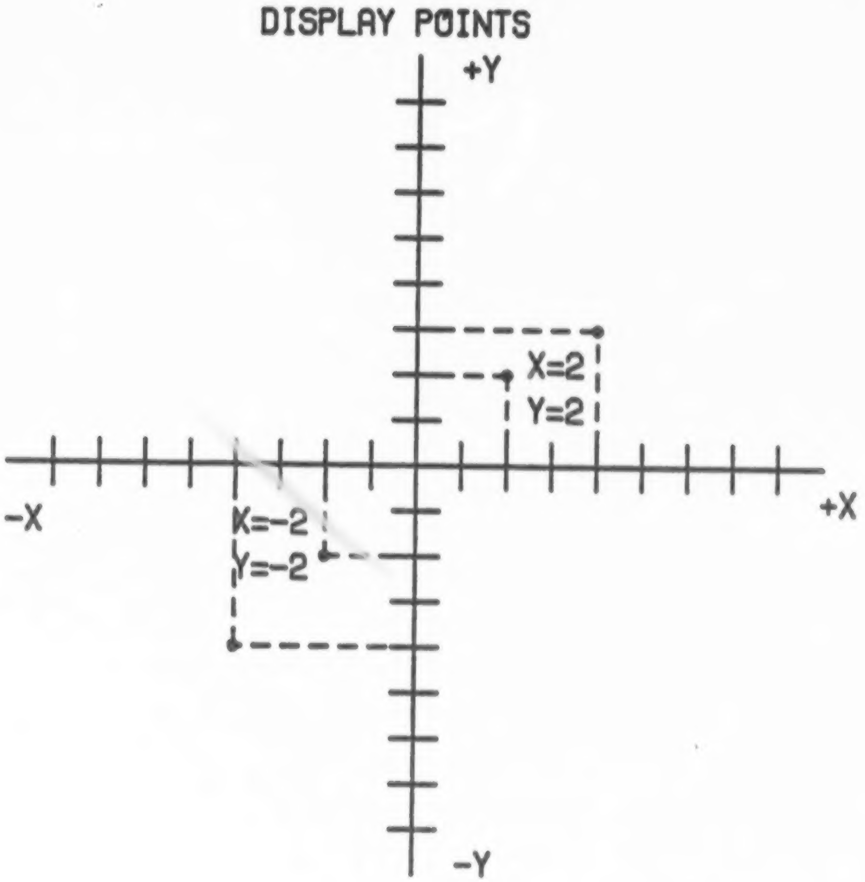
Example: Display points: (x=2, y=2)
(x=-2, y=-2)


DISPLAY POINTS
+Y
X=2
Y=2
-X
+X
X=-2
Y=-2
-Y

INCREMENTAL COORDINATE

(Synonymous with relative coordinate) An Incremental Coordinate point is a new point, with the value being measured from the last point given. Therefore, the new point is set from the last x, y coordinate defined.

Example 3: Using points (x=2, y=2) and (x=-2, y=-2), find incremental points (x=2, y=2) and (x=-2, y=-2).

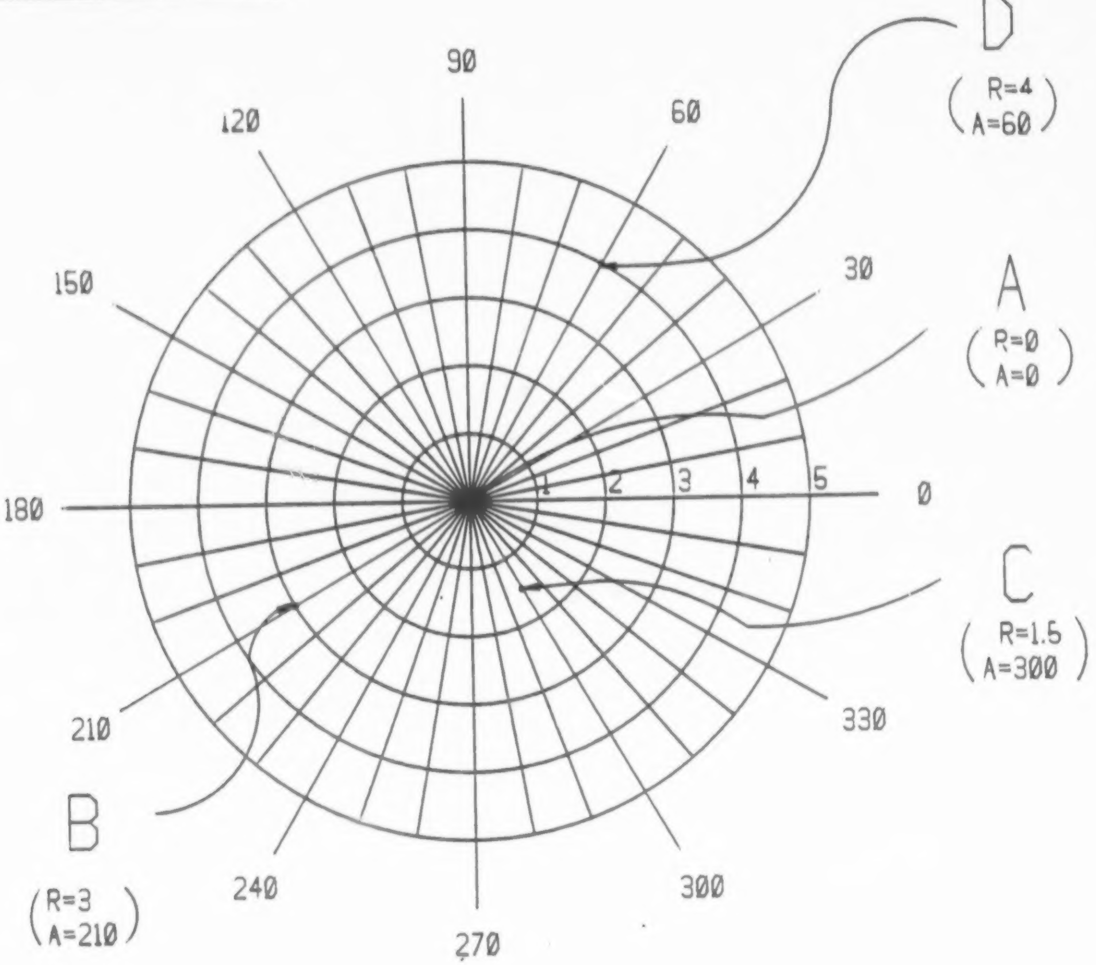


INFORMATION SHEET B 6.1 (continued)

POLAR COORDINATE

A polar coordinate is determined by an angle and the distance or radius from a polar point. The angle is in degrees and is measured in a counter-clockwise direction from the horizontal.

POLAR COORDINATES		
POINT	RADIUS	ANGLE
A	0	0
B	3	210
C	1.5	300
D	4	60


90
120
60
D
(R=4 A=60)
150
30
A
(R=0 A=0)
180
1
2
3
4
5
0
C
(R=1.5 A=300)
210
330
B
(R=3 A=210)
240
300
270

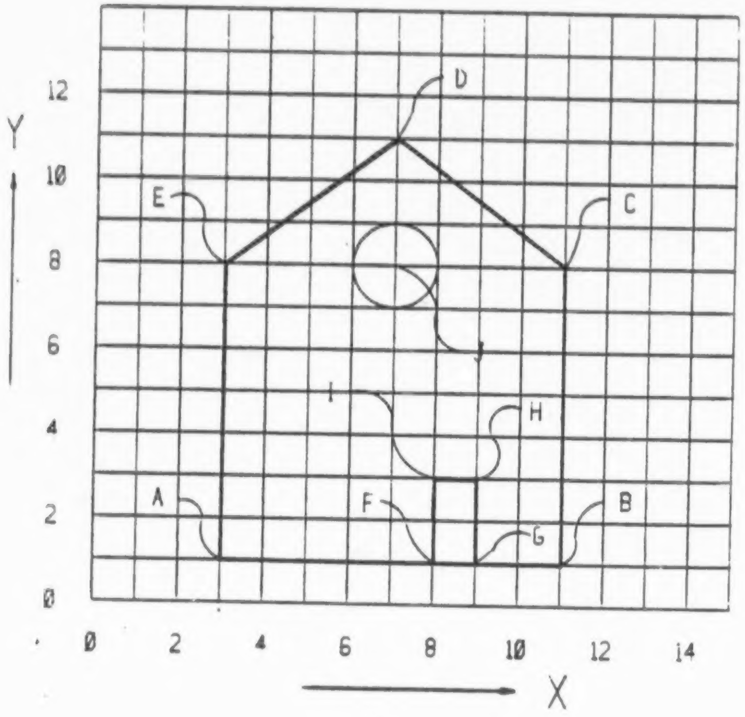
ACTIVITY SHEET

B 6.2

Coordinate Systems

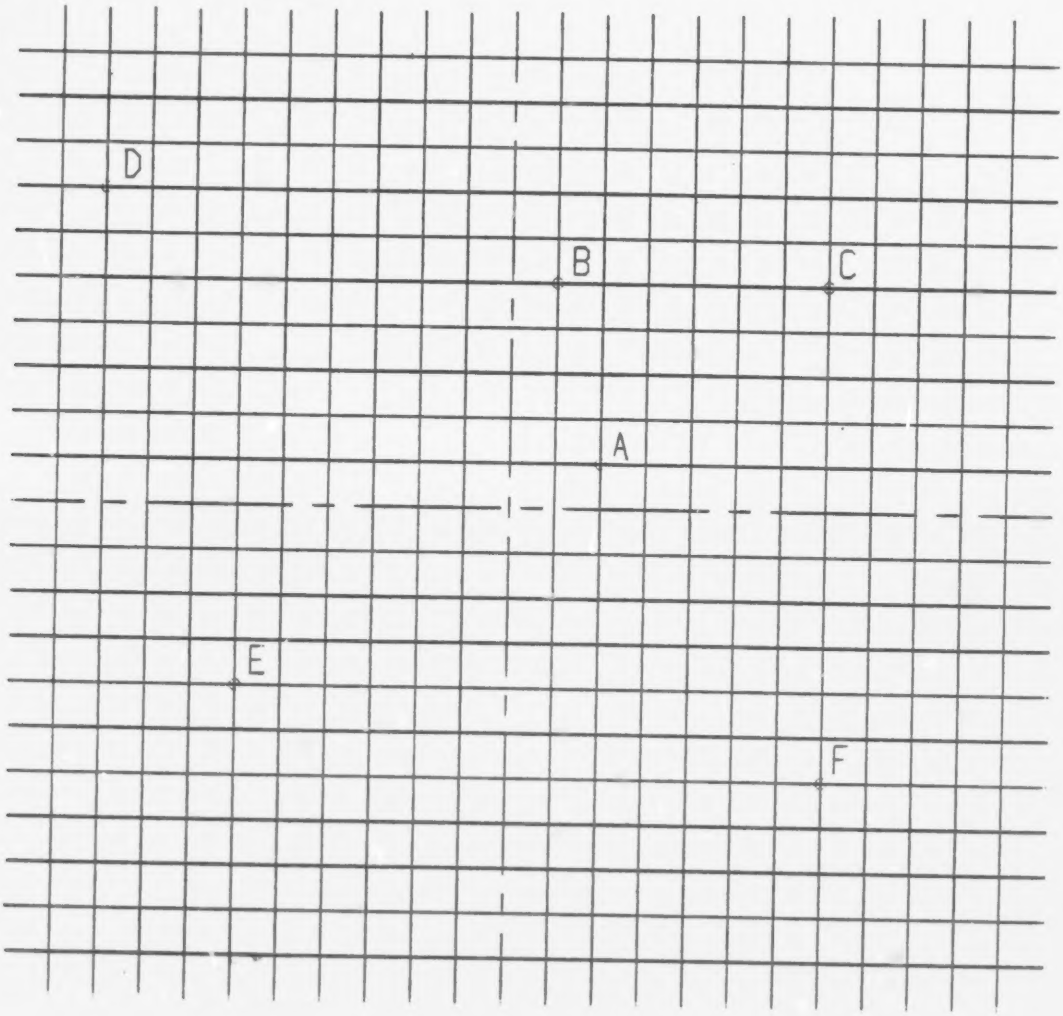
1. Refer to the following diagram. Locate the points and record their value on the given chart. Use the absolute coordinate system.

POINT	COORDINATES	
	X	Y
A		
B		
C		
D		
E		
F		
G		
H		
I		
J		


D
E
C
J
I
H
A
F
B
G
Y
12
10
8
6
4
2
0
0
2
4
6
8
10
12
14
X

ACTIVITY SHEET B 6.2 (continued)

2. Given point A located at (2.1), find the incremental coordinates of points B through F. Record these values on the given chart.



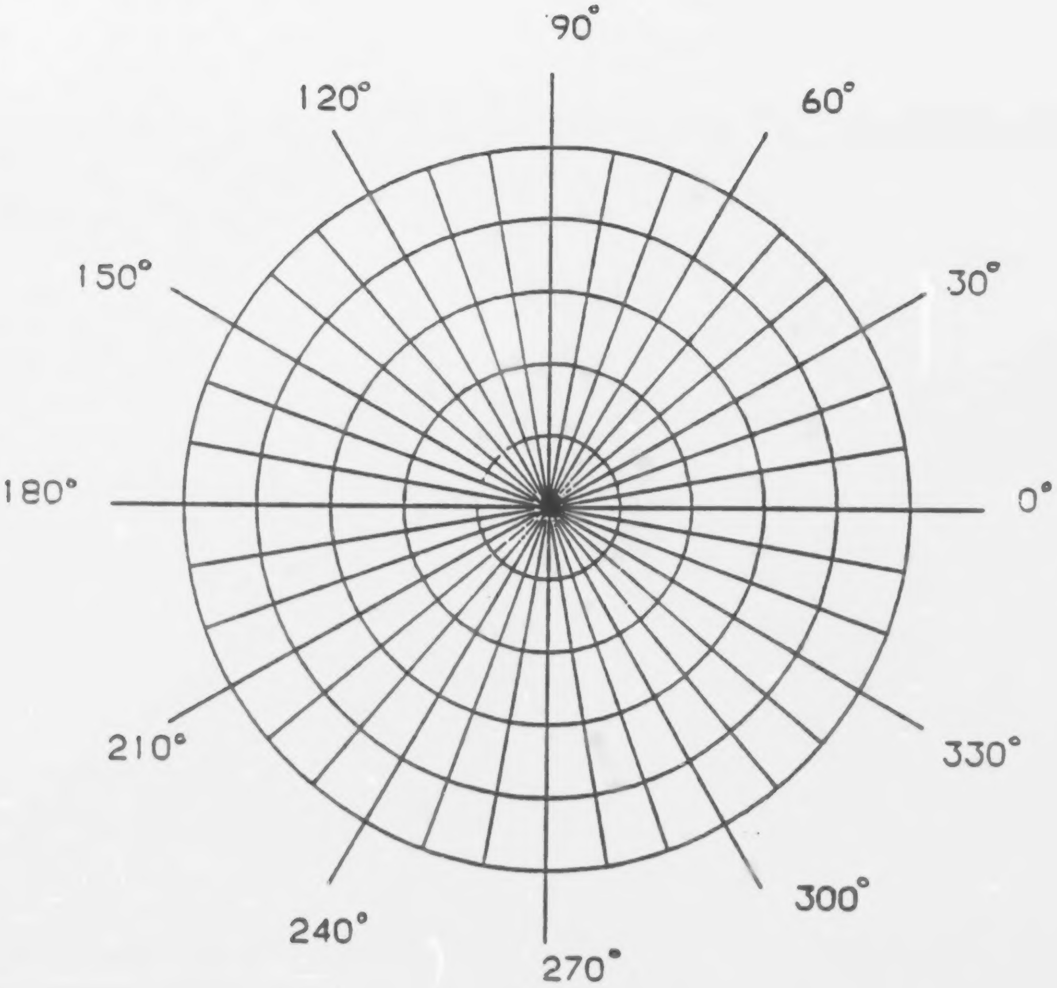
POINT	COORDINATES	
	X	Y
A		
B		
C		
D		
E		
F		

ACTIVITY SHEET B 6.2 (continued)

3. Given the following polar coordinate system, locate the points from information listed in the chart and label each point.

POLAR COORDINATES

Point	Radius	Angle
A	0	0
B	4	60
C	5	120
D	3	240
E	2	260
F	1	310
G	4	10

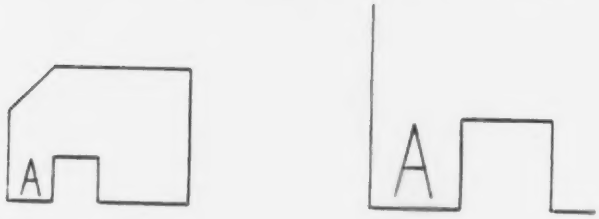

90°
120°
60°
150°
30°
180°
0°
210°
330°
240°
300°
270°

INFORMATION SHEET

B 6.3

Rotation and Zoom

ZOOM: ZOOM may be used to enlarge an object (zoom in) or reduce the size of an object (zoom out) on the screen.

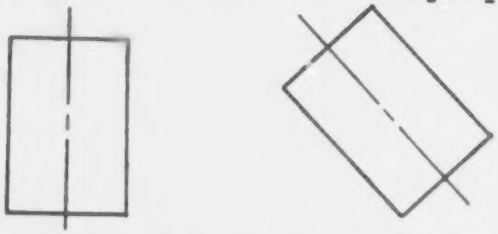


The general procedure used to zoom in/out of a drawing is as follows:

1. LOCATE the specific area to be zoomed.
2. SELECT the desired command, such as zoom in/zoom out.
3. SELECT the magnification/reduction factor. THE SYSTEM will then zoom in/out to your specifications.

Consult your Operator's Manual for specific command procedures.

ROTATION: Rotation is a type of manipulation which allows you to turn a displayed entity (line, circle, etc.), a group of entities, or the entire display through a given angle.



The general procedure used to rotate a drawing is as follows:

1. Select Rotate command.
2. Specify angle of rotation.
3. Press End or Return to complete the procedure.

Consult your Operator's Manual for specific command entries.

ACTIVITY SHEET

B 6.4

Rotation and Zoom

1. Construct an object similar to the one shown on Information Sheet B 6.3 dealing with zooming.
2. Locate the bottom left corner of the object and zoom in.
3. Zoom out to the original object size.
4. Zoom out until you have made the object approximately one-half of the initial size.
5. Construct an object similar to the one shown on the Information Sheet B 6.3 dealing with rotation.
6. Rotate the object through the following angles: 45°, 75°, 135°, 270°, and 315°.

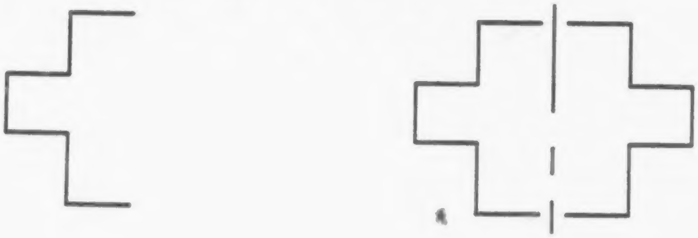
INFORMATION SHEET

B 6.5

Mirror and Copy Option

MIRROR

Mirroring is making a reflection of an image with respect to a reference point or points. This allows the operator to make an entity and mirror it, thus saving time.



The general procedure used to mirror an object is as follows:

1. Produce the figure that is to be mirrored.
2. Select the proper command to mirror the object.
3. Place the reference point/line along the axis which is to be mirrored.
4. Input the proper command to mirror the object.

Consult your CAD Operator's Manual for specific command procedures.

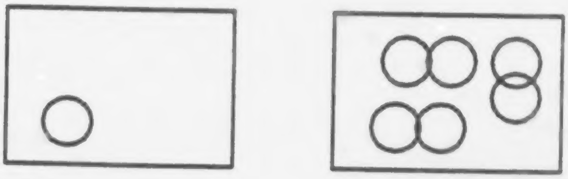
COPY

The copy function allows the user to make copies of a previously drawn entity any number of times.

The general procedure used to COPY an object is as follows:

1. Input COPY command.
2. Select entity to be duplicated.
3. Select new position and insert.

Consult your Operator's Manual for specific command procedures.



ACTIVITY SHEET

B 6.6

Copy and Mirror Option

1. Refer to Information Sheet B 6.5 dealing with mirroring.
    - A. Construct the object similar to the one shown in the original drawing.
    - B. Mirror it on the Y axis to complete the drawing.

2. Refer to Information Sheet B 6.5 dealing with the COPY option.
    - A. Construct a circle.
    - B. Copy it approximately eight times.
    - C. Construct a square in the middle of the screen.
    - D. Copy it in all four quadrants of the screen. (Contact your instructor to check your drawing.)

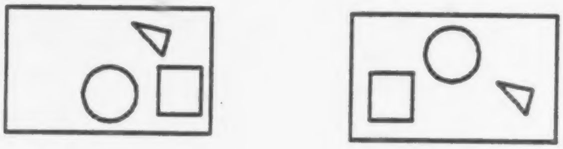
INFORMATION SHEET

B 6.7

Aligning and Moving an Object

MOVE

Allows the operator to move a single view, group, whole drawing, or entire display to a new position on the screen (CRT).



The general procedure used to move a single view on the screen is as follows:

1. Select appropriate command; i.e., MOVE, REPOSITION and NUDGE.
2. Specify the entity to be moved.
3. Specify the control point.
4. Locate new position of control point.

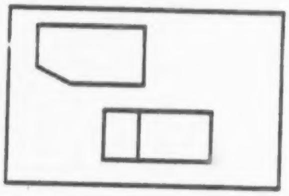
Consult your Operator's Manual for specific command entries.

INFORMATION SHEET B 6.7 (continued)

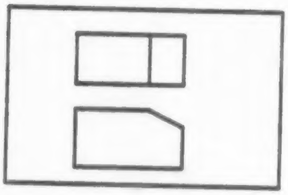
Aligning and Moving an Object

ALIGN

Aligning is a type of manipulation which allows you to move views in reference to each other, or in reference to other points or planes.



Original



Aligned

The general procedure used to align views is as follows:

1. Select appropriate command; i.e., AXIS LOCK, VERTICAL LOCK, etc.
2. Specify the correct alignment location.
3. Press END or RETURN to complete the procedure.

Consult your Operator's Manual for specific command entries.

ACTIVITY SHEET

B 6.8

Aligning and Moving Options

1. Construct a square, a triangle, and a circle on the screen similar to those shown in the example.
2. Move these geometric shapes around the screen in a random order.
3. Construct a front and top view similar to those in the original diagram on B 6.7 (continued). DO NOT align the views with one another.
4. Align the views in the correct relationship.

Contact instructor to check your drawing.

TASK: MANIPULATE GEOMETRIC SHAPES

TASK # B 6

PERFORMANCE/PRODUCT CHECKLIST

STUDENT'S NAME ______________________ PERFORMANCE ATTEMPT 1 2 3 4

EVALUATOR'S NAME ____________________ DATE OF ATTEMPT ___________

OBJECTIVE:

Given a CAD system you will MANIPULATE GEOMETRIC SHAPES.

DIRECTIONS TO THE STUDENT:

Before attempting this task for mastery, carefully review this checklist. You will be evaluated on the basis of this checklist. When you feel you are ready for evaluation, contact your instructor. You must score at least 16 out of 16 points, or achieve a score equivalent to 100% for mastery.

DIRECTIONS TO THE EVALUATOR:

The student will contact you when ready for evaluation. The student must score 16 out of 16 points, or achieve a score equivalent to 100% for mastery.

PERFORMANCE/PRODUCT CHECKLIST

B 6

DIRECTIONS:

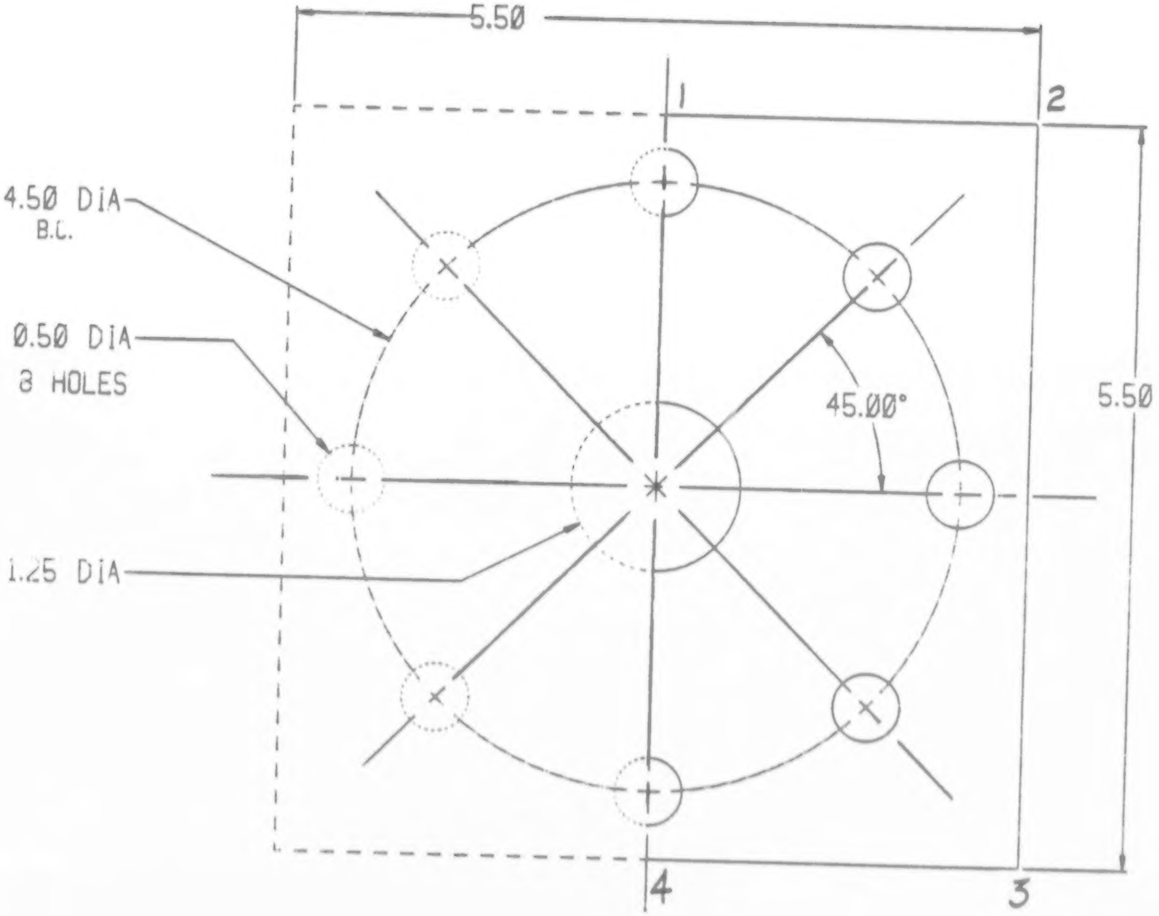
1. Layout .25 grid on screen.
2. Locate points 1-4 using the absolute coordinate system.
3. Layout center lines used to locate center of rectangular area.
4. Insert one - .5 inch diameter circle, and copy it at specified points.
5. Construct arcs at top and bottom positions in rectangle.

Call instructor to complete rest of the drawing.

6. Mirror object to completion.
7. Rotate object 45°.
8. Zoom in to area specified by the instructor.
9. Zoom out to original size.
10. Move object.

DRAWING

B 6


5.50
1
2
4.50 DIA
B.C.
0.50 DIA
8 HOLES
45.00°
5.50
1.25 DIA
4
3

PERFORMANCE/PRODUCT CHECKLIST

B 6

CRITICAL ITEMS	ITEMS TO BE OBSERVED OR CHECKED	RATING YES/NO
1.	Turned on power	--- ---
2.	Inserted proper disks	--- ---
3.	Logged/on	--- ---
4.	Set up proper grid	--- ---
5.	Located points on drawing	--- ---
6.	Located circles	--- ---
7.	Mirrored object	--- ---
8.	Zoomed in object	--- ---
9.	Zoomed out to original position	--- ---
10.	Moved object about the screen	--- ---
11.	Rotated object to correct angle	--- ---
12.	Stored drawing	--- ---
13.	Logged/off	--- ---
14.	Removed and returned disks to proper storage area	--- ---
15.	Turned off power	--- ---
16.	Student worked alone	--- ---

TOTAL POINTS EARNED -------

POINTS NEEDED FOR MASTERY ---16--

STUDENT LEARNING GUIDE

TASK B 7

DIMENSION SHAPES

PURPOSE: Dimensioning a drawing is essential to identify the size and location of its parts. An important part of CAD training is developing proper CAD dimensioning techniques to insure that a drawing is correctly dimensioned.

OBJECTIVE: Given a CAD system, you will DIMENSION SHAPES. To master this task, you must score 16 out of 16 points, or achieve a score equivalent to 100% on the Performance/Product Checklist.

LEARNING STEPS

B 7

READ:	Information Sheet B 7.1, "Dimensioning Shapes," for the procedures used in dimensioning.
READ:	Operator's Manual on Dimensioning Procedures.
COMPLETE:	Activity Sheet B 7.2, "Dimensioning Shapes," to practice dimensioning.
COMPLETE:	Performance Checklist B 7, DIMENSIONING SHAPES, using CAD to demonstrate mastery of this task. Contact your instructor.

INFORMATION SHEET

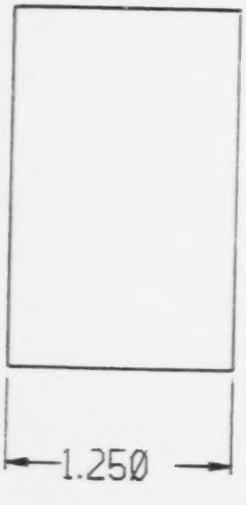
B 7.1

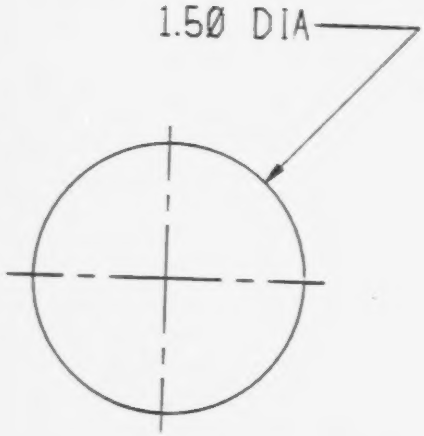
Dimensioning Shapes

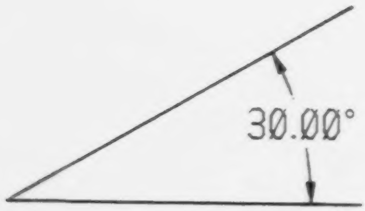
The main purpose of any drawing is to show someone the size and shape of an object. Before the drawing can be fully understood, it must provide a complete size description (dimensionally). In drafting, dimensions must be given in a specific manner, showing specific information. When a CAD system is used, many dimensioning functions are done automatically.

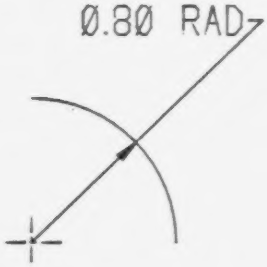
When an object has been completely drawn on a CAD system, it then is ready for the placement of dimensions. Most systems have a dimensioning mode that must be entered. The various entities of the drawing, lines, circles, arcs, and angles must be selected first, before the computer places the dimension on the drawing. The addition of arrowheads may or may not be drawn automatically.

Refer to your Operator's Manual for specific instructions for dimensioning lines, arcs, circles, and angles. The following is an example of how these entities might be dimensioned.









ACTIVITY SHEET

B 7.2

Dimensioning Shapes

1. Using your Operator's Manual, investigate the dimensioning capabilities of your CAD system.

   A. Number of digits following decimal point______________.
   B. Text height_____________________________.

2. Using your Operator's Manual, study the commands for dimensioning:

   A. Linear Dimension
      1. Horizontal
      2. Vertical

   B. Radial Dimensions

   C. Diameter Dimensions

   D. Angular Dimensions

   E. Changing Dimensions

3. Using your CAD system, draw and dimension the object from Information Sheet B 7.1. Have your instructor check your work.

TASK: DIMENSION SHAPES AND OBJECTS

TASK # B 7

PERFORMANCE/PRODUCT CHECKLIST

STUDENT'S NAME ______________________ PERFORMANCE ATTEMPT 1 2 3 4

EVALUATOR'S NAME ____________________ DATE OF ATTEMPT ___________

OBJECTIVE:

Given a CAD system, you will DIMENSION SHAPES.

DIRECTIONS TO THE STUDENT:

Before attempting this task for mastery, carefully review this checklist. You will be evaluated on the basis of this checklist. When you feel you are ready for evaluation, contact your instructor. You must score at least 16 out of 16 points, or achieve a score equivalent to 100% for mastery.

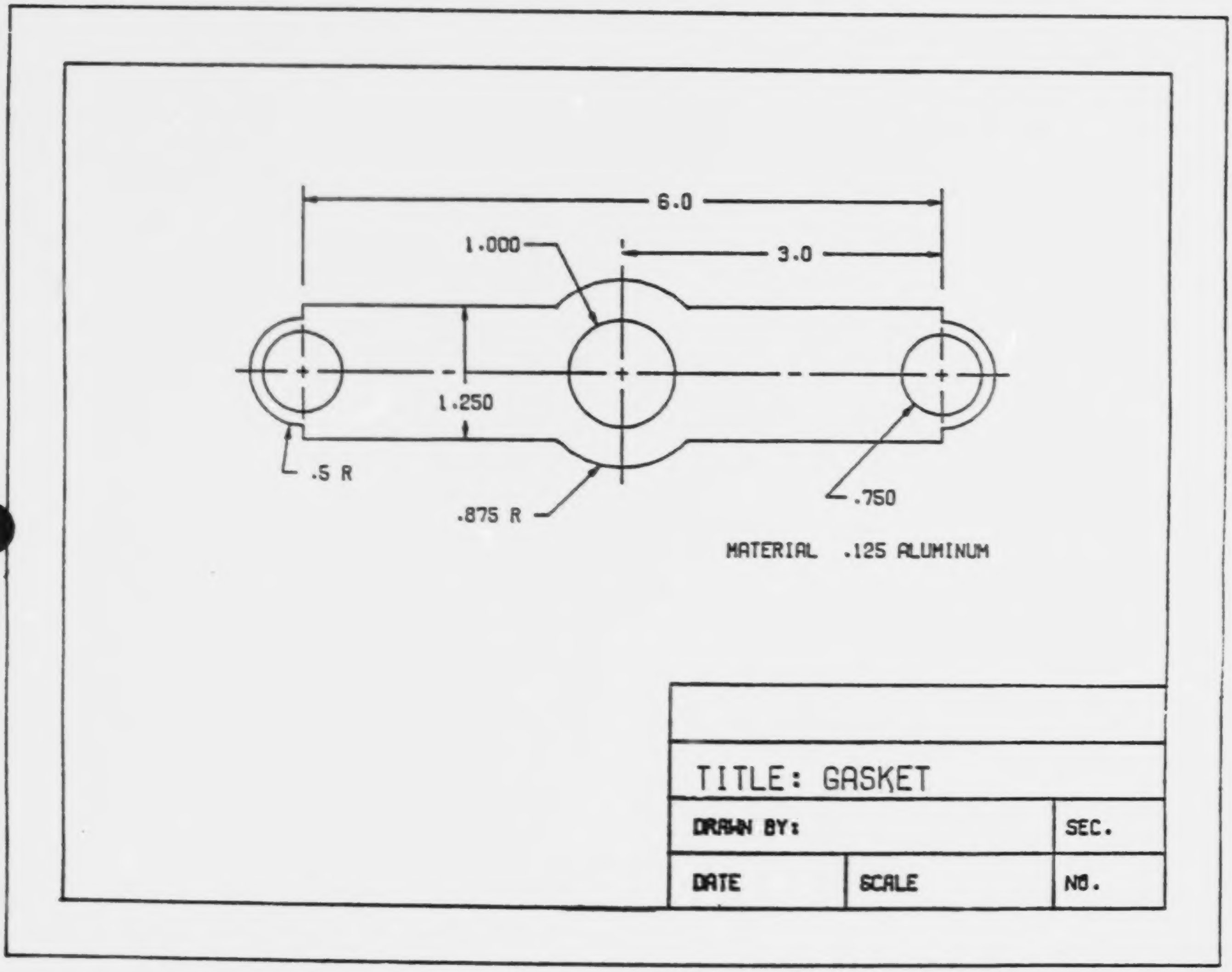
DIRECTIONS TO THE EVALUATOR:

The student will contact you when ready for evaluation. The student must score 16 out of 16 points, or achieve a score equivalent to 100% for mastery.

CHECKLIST DRAWING

B 7

Using your CAD system, draw and dimension the object below.


6.0
1.000
3.0
1.250
.5 R
.875 R
.750
MATERIAL .125 ALUMINUM
TITLE: GASKET
DRAWN BY:
SEC.
DATE
SCALE
NO.

PERFORMANCE/PRODUCT CHECKLIST

B 7

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING	
		YES	NO
1.	Turned on power	---	---
2.	Inserted proper disks	---	---
3.	Logged on	---	---
4.	Created a new drawing file	---	---
5.	Used correct views	---	---
6.	Included all arrowheads	---	---
7.	Located dimension lines properly	---	---
8.	Used arc leaders	---	---
9.	Dimensioned circle locations properly	---	---
10.	Included circle diameter	---	---
11.	Included arc dimension	---	---
12.	Filed drawing correctly	---	---
13.	Logged off	---	---
14.	Removed and stored disks	---	---
15.	Turned power off	---	---
16.	Student worked alone	---	---

TOTAL POINTS EARNED ------

POINTS NEEDED FOR MASTERY --16--

STUDENT LEARNING GUIDE

TASK B 8

USE DIGITIZING TECHNIQUES TO COPY EXISTING DRAWINGS

PURPOSE: Digitizing converts lines, symbols, sketches, drawings, and text into a language a computer can understand. It is necessary for a student to be able to use various digitizing devices as a means of efficiently and accurately entering data into a CAD system.

OBJECTIVE: Given a cad system with an appropriate digitizing device, you will USE DIGITIZING TECHNIQUES TO COPY EXISTING DRAWINGS. To master this task you must answer 7 out of 8 items correctly, or achieve a score equivalent to 87% on the Written Exam and score 19 out of 19 points, or achieve a score equivalent to 100% on the Product/Performance Checklist.

LEARNING STEPS

B 8

READ: Information Sheet B 8.1, "Digitizing Techniques," for an introduction to digitizing.

COMPLETE: Activity Sheet B 8.2, "Digitizing Techniques," for a self-check on digitizing.

READ: Operator's Manual on Digitizing.

COMPLETE: Activity Sheet B 8.3, "Digitizing," to practice digitizing.

COMPLETE: Performance Checklist B 8, DIGITIZING TECHNIQUES, to demonstrate mastery of this task. Contact your instructor.

COMPLETE: Written Exam B 8, DIGITIZING TECHNIQUES. Contact your instructor.

INFORMATION SHEET

B 8.1

Digitizing Techniques

The digitizer is an important component of a CAD system. Digitizing is entering into the drawing world, X-Y coordinate positions of a point. Numerous drafting tasks could not be performed without CAD system digitizers. One purpose of the digitizer is to rapidly convert data from an existing drawing on paper into the CAD system in digital form. Digitizing is also a method of placing new drawings into the system by locating specific points on the grid with a digitizing device.

Several digitizing devices are available. These include a stylus type and a puck type, both of which work with a graphics tablet.

The graphics (digitizing) tablet is an input device having a flat surface which can vary in size from a small A-Size (9" x 12") to larger than an E-Size (36" x 48") surface. Tablets may have standard or custom menu commands. Below the tablet surface is a series of wires in a grid pattern that detect electromagnetic impulses at the desired X-Y coordinate locations and are activated by the puck or stylus. These electrical impulses are transferred to the computer and show the locations to the cursor on the CRT. The puck is a flat object containing one or more control buttons and is connected to the graphics tablet. The puck incorporates a lens with fine cross hairs used to reference points on the graphics tablet grid. When the desired point is selected, the control button is depressed which causes the desired X-Y coordinate point location to be entered into the memory of the computer.

The micro-switch type of stylus pen is operated in much the same way as the puck. When the desired X-Y coordinate is selected, the pen is depressed to activate the micro-switch and the point location is fed into the memory of the computer.

Examples of industries that use digitizing methods to input drawings into a computer are the architectural, mechanical, piping design/layout and electronic circuit design engineering fields. Many industries use digitizing to enter existing hand drawn file drawings into the computer to store drawings for future updating.

ACTIVITY SHEET

B 8.2

DIGITIZING TECHNIQUES

Answer the following:

1. What is meant by digitizing?

2. Describe and explain the function of a graphics tablet.

3. List two sizes of graphics tablets commonly available.

4. Describe a puck and its function as a digitizing device.

5. What is another name given to a puck?

6. Describe the difference between a light pen and a stylus with a micro-switch.

7. What is a tablet menu and how is it used with a graphics tablet?

8. How is the cursor on the CRT affected by the digitizer?

9. List three kinds of industries which use digitizing techniques.

   1.
   2.
   3.

10. How is digitizing used when a company converts to CAD?

ACTIVITY SHEET

B 8.3

Digitizing

Do the following digitizing problems to become familiar with a digitizing device.

Refer to Operator's Manual for specific information on use of the digitizer.

See instructor for a copy of Figure 1.

1. Place and tape this sheet on the digitizing tablet area.

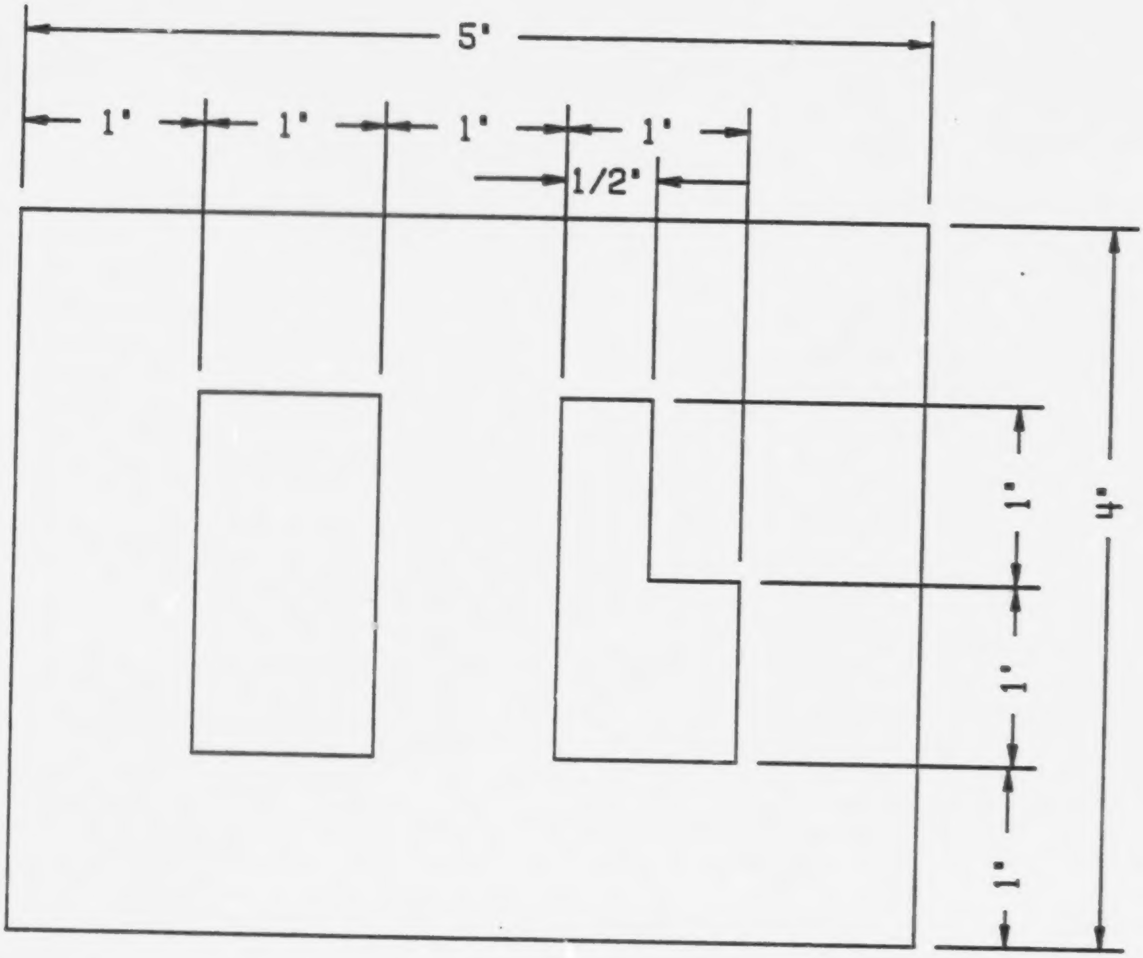
   A. Digitize the shapes in Figure 1 by aligning the intersections of the shapes given with the puck or stylus. Check with instructor; then delete drawing. Remove this sheet from the tablet surface.

   B. Set up a 1/2" x 1/2" grid. Digitize the shapes in Figure 1 to actual size. Snap to grid points and omit dimensions. When completed, have instructor check the screen display.

2. Set up a 1/2" x 1/2" grid. In grid snap, digitize the shape in Figure 2. Add title block and text as shown. Omit placement of the dimensions. Have instructor check the CRT display when completed.

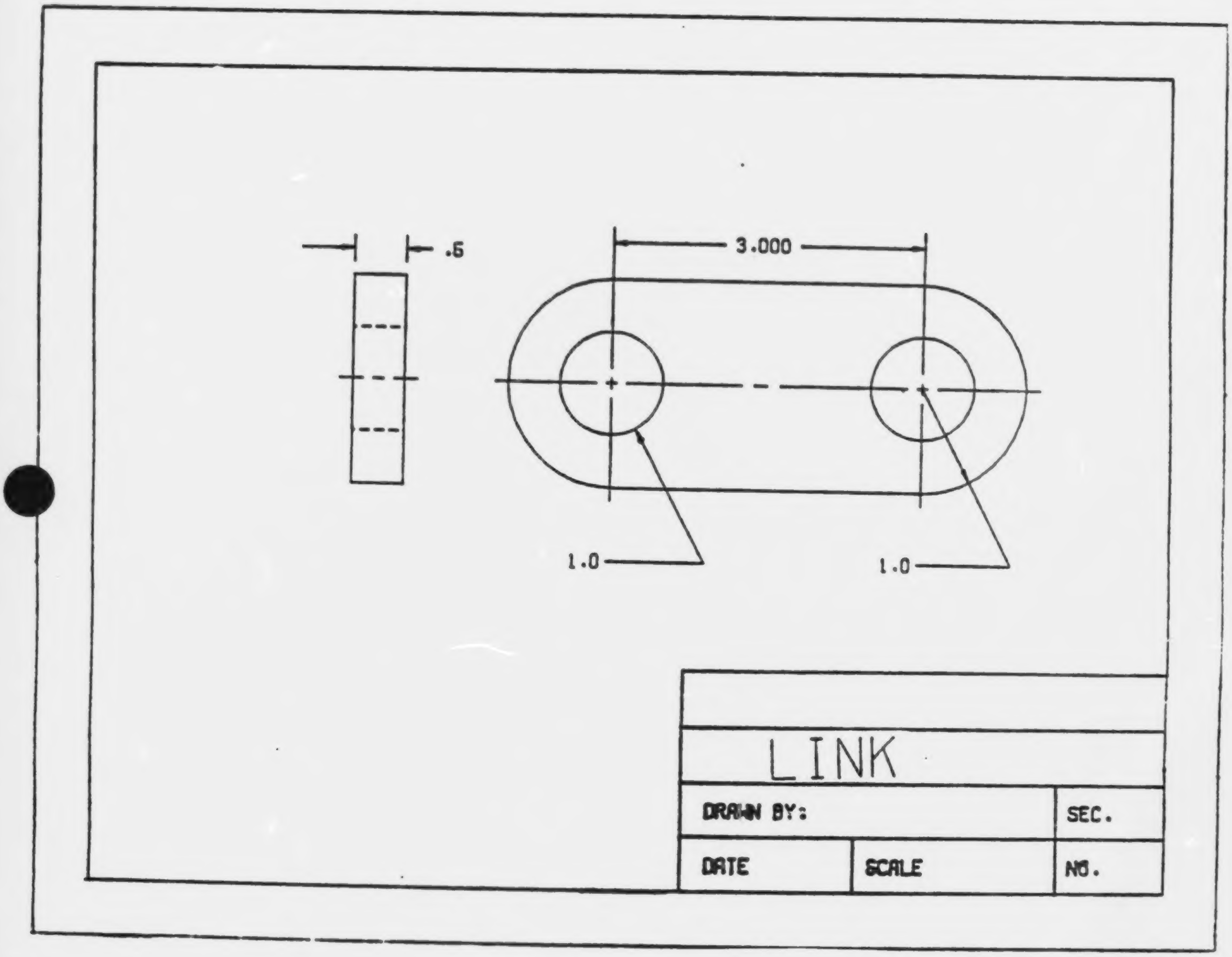
ACTIVITY SHEET B 8.3 (continued)

Figure 1


5'
1'
1'
1'
1'
1/2"
4"
1'
1'
1'

ACTIVITY SHEET B 8.3 (continued)

Figure 2


.5
3.000
1.0
1.0
LINK
DRAWN BY:
SEC.
DATE
SCALE
NO.

TASK: USE DIGITIZING TECHNIQUES

TASK # B 8

PERFORMANCE/PRODUCT CHECKLIST

STUDENT'S NAME ______________________ PERFORMANCE ATTEMPT 1 2 3 4

EVALUATOR'S NAME ____________________ DATE OF ATTEMPT ___________

OBJECTIVE:

Given a CAD system with an appropriate digitizing device, you will USE DIGITIZING TECHNIQUES to copy existing drawings.

DIRECTIONS TO THE STUDENT:

Before attempting this task for mastery, carefully review this checklist. You will be evaluated on the basis of this checklist. When you feel you are ready for evaluation, contact your instructor. You must score at least 19 out of 19 points, or achieve a score equivalent to 100%, for mastery.

DIRECTIONS TO THE EVALUATOR:

The student will contact you when ready for evaluation. The student must score 19 out of 19 points, or achieve a score equivalent to 100%, for mastery.

PERFORMANCE/PRODUCT CHECKLIST

B 8

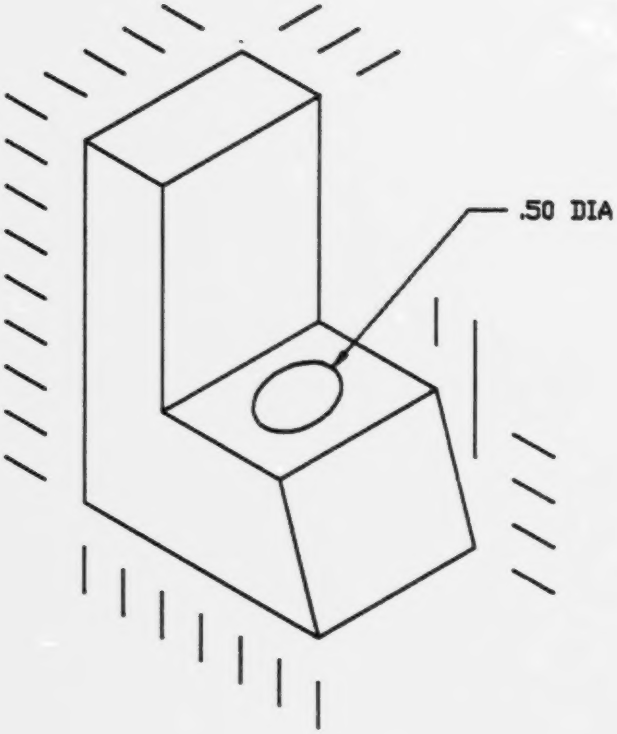
Do the following problem to increase your skill in digitizing.

1. Given the object in Figure 3 and a sheet of grid paper (see instructor), sketch a 3-View drawing to full scale on the grid paper. Include all necessary lines. Border layout is maximum screen size and title block is 1" x 2".

2. Set up a 1/2" x 1/2" grid and use the snap function. Attach grid paper to graphics tablet surface and digitize the drawing.

B 8

Figure 3



PERFORMANCE/PRODUCT CHECKLIST

B 8

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
1.	Turned power on	--- ---
2.	Inserted disk properly	--- ---
3.	Logged on	--- ---
4.	Aligned drawing on grid sheet	--- ---
5.	Attached grid squarely to graphics tablet	--- ---
6.	Set-up 1/2" x 1/2" screen grid	--- ---
7.	Used correct views	--- ---
8.	Included all necessary lines	--- ---
9.	Utilized grid snap function	--- ---
10.	Digitized points accurately	--- ---
11.	Included 1" x 2" title block	--- ---
12.	Placed text correctly	--- ---
13.	Used maximum screen size border	--- ---
14.	Used full scale	--- ---
15.	Stored drawing	--- ---
16.	Logged off	--- ---
17.	Turned power off	--- ---
18.	Removed and stored disks	--- ---
19.	Student worked alone	--- ---
	TOTAL POINTS EARNED	------
	POINTS NEEDED FOR MASTERY	--19--

EXAM

Version 1

Task B 8

DIRECTIONS:

THE PURPOSE OF THIS EXAM IS TO DETERMINE WHETHER OR NOT YOU HAVE UNDERSTOOD THE INFORMATION ON DIGITIZING TECHNIQUES.

Each of the questions or incomplete statements below is followed by several words, phrases, or a series of numbers. Choose the one which best answers the question or completes the statement correctly. Place the letter associated with that choice (A, B, C, or D) in the numbered blank space on your ANSWER SHEET. DO NOT WRITE ON THIS TEST! To master this exam, you must answer 7 out of 8 items correctly, or achieve a score equivalent to 87%.

1. The process of entering data point by point on the X-Y axis is known as

   A. Programming
   B. Displaying
   C. Plotting
   D. Digitizing

2. Another common name for puck is

   A. Light pen
   B. Mouse
   C. Stylus
   D. Graphics tablet

3. A list of commands which can be fastened to the graphics tablet is the

   A. Tablet menu
   B. Puck
   C. Digitizer
   D. Master list

EXAM B 8, Version 1 (continued)

4. The bright mark which moves to locate positions on the display screen is the

   A. Dot
   B. Crosshair
   C. Cursor
   D. Checkmark

5. A very common digitizing device used with a graphics tablet is the

   A. Thumbwheel
   B. Puck or Stylus
   C. Game paddles
   D. Joystick

6. Which of the following digitizers utilizes cross hairs?

   A. Light pen
   B. Stylus
   C. Joystick
   D. Puck

7. [illegible] common size graphics tablet used with a microcomputer based system is

   A. 5" x 8"
   B. 9" x 12"
   C. 50" x 60"
   D. 4' x 8'

8. Companies converting to CAD use digitizing

   A. To set up parts lists
   B. To enter existing drawings into computer files
   C. To make mailing lists
   D. To prepare sales reports

EXAM

Version 2

Task B 8

NAME ______________________________

DIRECTIONS:

THE PURPOSE OF THIS EXAM IS TO DETERMINE WHETHER OR NOT YOU HAVE UNDERSTOOD THE INFORMATION ON DIGITIZING TECHNIQUES.

Each of the questions or incomplete statements below is followed by several words, phrases, or a series of numbers. Choose the one which best answers the question or completes the statement correctly. Place the letter associated with that choice (A, B, C, or D) in the numbered blank space on your ANSWER SHEET. DO NOT WRITE ON THIS TEST! To master this exam, you must answer 7 out of 8 items correctly, or achieve a score equivalent to 87%.

1. A common size graphics tablet used with a microcomputer based system is

   A. 5" x 8"
   B. 9" x 12"
   C. 50" x 60"
   D. 4' x 8'

2. Which of the following digitizers utilizes crosshairs?

   A. Light pen
   B. Stylus
   C. Joystick
   D. Puck

3. The process of entering data point by point on the X-Y axis is known as

   A. Programming
   B. Displaying
   C. Plotting
   D. Digitizing

4. Companies converting to CAD use digitizing

   A. To set up parts lists
   B. To enter existing drawings into computer files
   C. To make mailing lists
   D. To prepare sales reports

EXAM B 8, Version 2 (continued)

5. A very common digitizing device used with a graphics tablet is the

   A. Thumbwheel
   B. Puck or Stylus
   C. Game paddles
   D. Joystick

6. The bright mark which moves to locate positions on the display screen is the

   A. Dot
   B. Crosshair
   C. Cursor
   D. Checkmark

7. Another common name for puck is

   A. Light pen
   B. Mouse
   C. Stylus
   D. Graphics tablet

8. A list of commands which can be fastened to the screen or graphics tablet is the

   A. Tablet menu
   B. Puck
   C. Digitizer
   D. Master list

STUDENT LEARNING GUIDE

TASK B 9

USE LAYERING TECHNIQUES

PURPOSE: Layering techniques allow the operator the ability to produce specific entities or "parts" and place this information on separate layers or "transparent overlays." The CAD operator has the ability to call up a layer or any combination of layers. This learning guide will explain layering techniques and how to use them.

OBJECTIVE: Given a CAD system and drawing problem, you will USE LAYERING TECHNIQUES. To master this task, you must score 15 out of 15 items correctly, or achieve a score equivalent to 100% on the Product/Performance Checklist.

LEARNING STEPS

B 9

READ:	Information Sheet B 9.1, "Layering Techniques," for an introduction to layering techniques.
READ:	Operator's Manual on Layering Techniques.
COMPLETE:	Activity Sheet B 9.2, "Layering Techniques."
COMPLETE:	Performance/Product Checklist B 9 to demonstrate mastery of this task. Contact your instructor.

INFORMATION SHEET

B 9.1

Layering Techniques

One of the unique features of a CAD system is the ability to layer drawings or parts within a drawing. A layer can be considered a transparent sheet. Parts of a drawing may be created on different layers or "overlays." Another part (or parts) also on a transparent sheet can be placed on top of it, and the result appears to be a single drawing. Many CAD systems have the capacity of 250 or more layers.

On a CAD system these sheets or layers may be called up one at a time and worked on separately, or all the layers may be called up to display a completed drawing.

Another example of utilizing layering techniques can be found in architecture. After the floor plan is drawn on the first layer, furniture may then be drawn on a second layer, moved, modified, and positioned, without disturbing the previously drawn floor plan.

Refer to your Operator's Manual on specific layering commands and procedures.

ACTIVITY SHEET

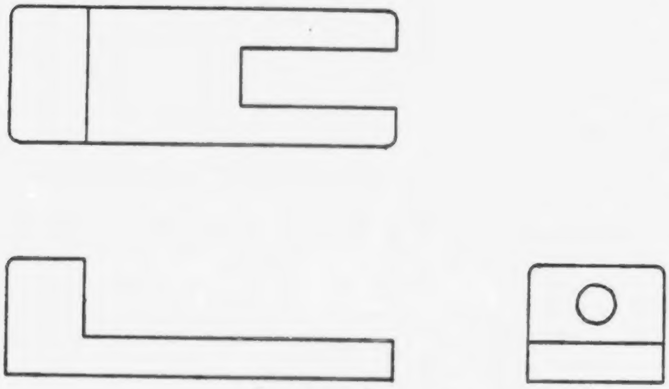
B 9.2

Layering Techniques

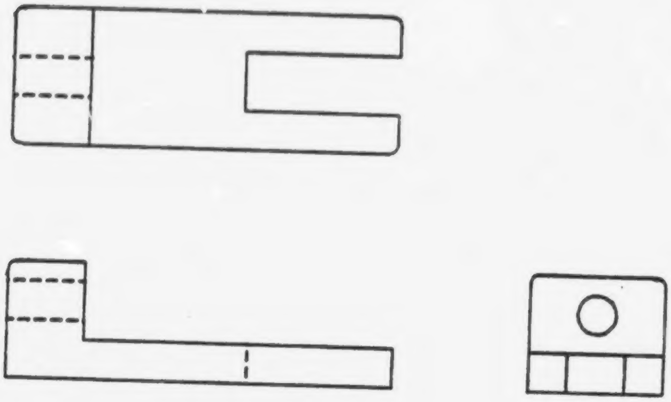
1. Using your Operator's Manual, list the commands and procedures to layer a drawing on your CAD system.
2. Construct a "L-BLock" using 5 layers. Use Figure 1 as a guide in construction. Make each layer separate. You should be able to recall any combinations of layers.

ACTIVITY SHEET B 9.2 (continued)

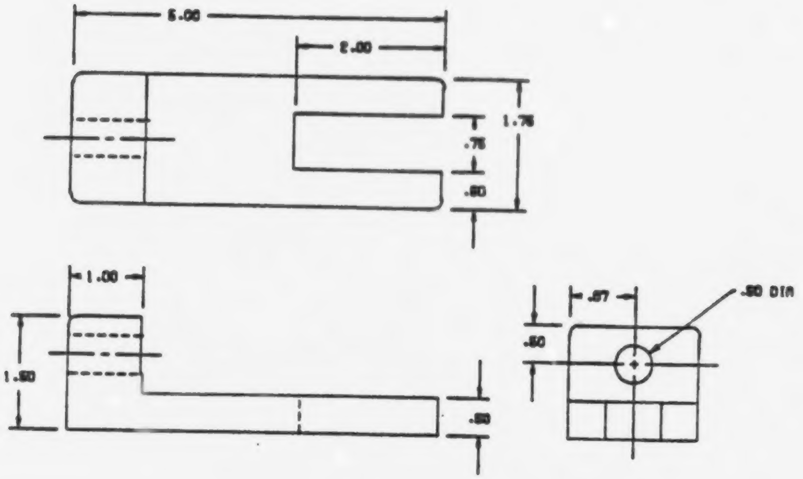
FIGURE 1



Layer 1



Layer 2



5.00
2.00
1.75
.75
.50
1.00
1.50
.50
.87
.50
.50 DIA

Layers 1, 2, & 3

TASK: USE LAYERING TECHNIQUES

TASK # B 9

PERFORMANCE/PRODUCT CHECKLIST

STUDENT'S NAME ______________________ PERFORMANCE ATTEMPT 1 2 3 4

EVALUATOR'S NAME ____________________ DATE OF ATTEMPT ___________

OBJECTIVE:

Given a CAD system and a drawing problem, you will USE LAYERING TECHNIQUES.

DIRECTIONS TO THE STUDENT:

Before attempting this task for mastery, carefully review this checklist. You will be evaluated on the basis of this checklist. When you feel you are ready for evaluation, contact your instructor. You must score at least 15 out of 15 points, or achieve a score equivalent to 100% for mastery.

DIRECTIONS TO THE EVALUATOR:

The student will contact you when ready for evaluation. The student must score 15 out of 15 points, or achieve a score equivalent to 100% for mastery.

PERFORMANCE/PRODUCT CHECKLIST

B 9

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
1.	Turned on power	--- ---
2.	Inserted proper disks	--- ---
3.	Logged on	--- ---
4.	Chose layer one	--- ---
5.	Constructed drawing on layer one as shown	--- ---
6.	Chose layer two	--- ---
7.	Constructed drawing on layer two as shown	--- ---
8.	Chose layer three	--- ---
9.	Constructed drawing on layer three as shown	--- ---
10.	Stored drawings	--- ---
11.	Plotted or printed drawings as instructed	--- ---
12.	Logged off	--- ---
13.	Return disks to storage area	--- ---
14.	Turn power off	--- ---
15.	Student worked alone	--- ---

TOTAL POINTS EARNED ------

POINTS NEEDED FOR MASTERY --15--

STUDENT LEARNING GUIDE

TASK B 10

DEVELOP AND USE A COMPONENT LIBRARY

PURPOSE: In order to increase your speed in drawing a part, most CAD systems allow you to develop and apply components to a drawing. Components are symbols that are commonly found on a drawing. Typical symbols which might be used in electronic drafting are a switch or a resistor. Other areas of drafting (architectural, mechanical, and piping) have their own symbols which are used consistently throughout a drawing.

OBJECTIVE: Given a CAD system, you will DEVELOP AND USE A COMPONENT LIBRARY. To master this task, you must score 15 out of 15 points, or achieve a score equivalent to 100% on the Performance/Product Checklist.

LEARNING STEPS

B 10

Components and Component Libraries

READ:	Information Sheet B 10.1, "Components and Component Libraries."
COMPLETE:	Activity Sheet B 10.2, "Developing and Using Component Libraries."
READ:	Operator's Manual section on component library development and use.
COMPLETE:	Activity Sheet B 10.3, "Using a Component Library."
COMPLETE:	Performance/Product Checklist B 10; develop and use a component library to demonstrate mastery of this task. Contact your instructor.

INFORMATION SHEET

B 10.1

Components and Component Libraries

In a CAD system a component library is simply a place to store symbols which are repeatedly used. Any type of symbol can be created and placed in a library. Component libraries typically consist of architectural, mechanical, electrical, piping, welding, and similar symbols. Very specialized libraries may contain special line types or even small, frequently used parts. Symbols are usually found on the templates associated with a specific drafting area. Templates which contain these symbols can be compared to and used in the same way as a component library. The component library is simply a collection (often referred to as a group) of symbols.

A component library is created by first producing a matrix overlay. This is where the library component symbols are placed. Symbols are then designed in conventional form on the CAD system and placed into the matrix overlay file in a specific location. Various means of operating libraries exist, depending on the type of CAD system being used. Some systems can easily store more than 100 symbols.

As state above, once the library is created, it is possible to plot out an overlay which contains drawings of the symbols in the library. This overlay is fastened to the digitizer tablet and becomes a menu pad from which the symbols desired can quickly be picked and automatically drawn on the screen. The user simply touches the symbol on the menu overlay with the puck or stylus, and the computer draws the symbol. The user can then manipulate the symbol by a reference point of the symbol to locate it on a drawing in a specified place. Some systems allow the symbol to be scaled to different sizes.

Most systems allow symbols to be deleted from a library and replaced with new or updated symbols. Some systems permit a symbol in the library to be revised while others do not have this feature.

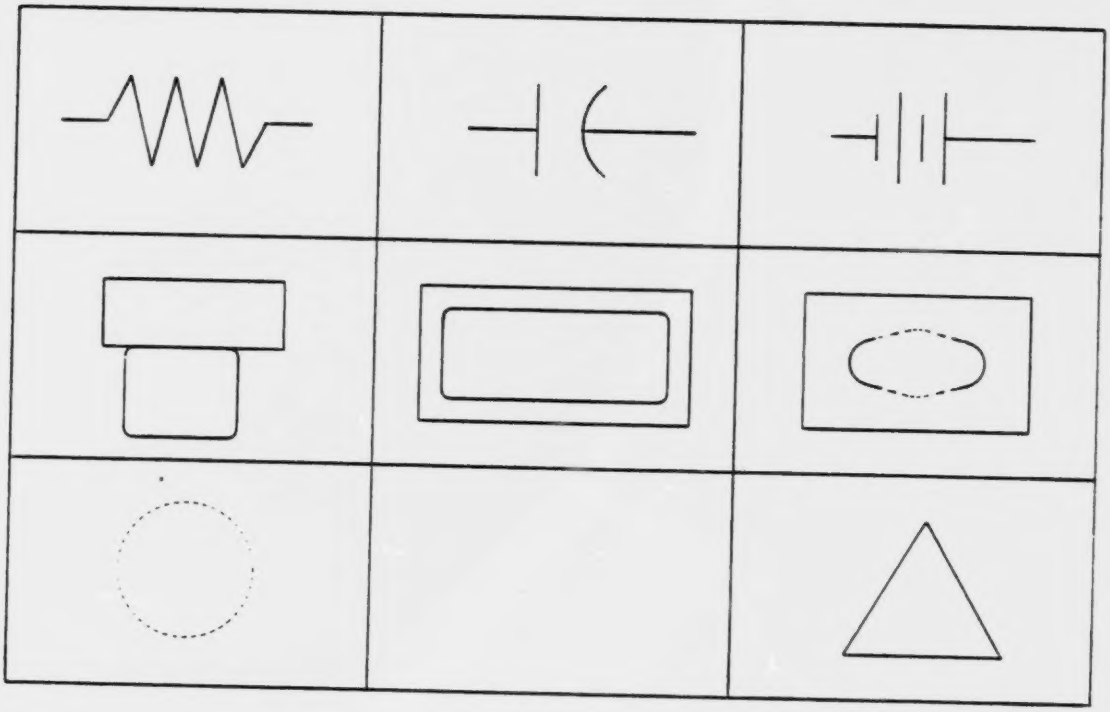
The following is a common procedure used for creating a component library and symbols for the library (refer to Operator Manual for specific procedure):

1. Create a new library matrix overlay. (This is the overlay which will contain drawing symbols.) Also, type in the name of the library you want. (Example: Arch #1, Pipe #1, Mech., etc.)

INFORMATION SHEET B 10.1 (continued)

2. Add symbols to library
    a. Name symbols
    b. Draw object
    c. Insert into library

SAMPLE COMPONENT LIBRARY WITH MATRIX OVERLAY AND SYMBOLS



ACTIVITY SHEET

B 10.2

Developing and Using Component Libraries

1. Sketch six different symbols which could be used in the following areas. You may use any available resources.

   a. Architectural drawings

      (1)

      (2)

      (3)

      (4)

      (5)

      (6)

   b. Mechanical drawings

      (1)

      (2)

      (3)

      (4)

      (5)

      (6)

   c. Piping drawings

      (1)

      (2)

      (3)

      (4)

      (5)

      (6)

ACTIVITY SHEET B 10.2 (continued)

d. Electronic drawings

(1)

(2)

(3)

(4)

(5)

(6)

e. Electrical drawings

(1)

(2)

(3)

(4)

(5)

(6)

2. Define a component library.

3. Why would you use a stored component on a drawing?

ACTIVITY SHEET

B 10.3

Develop and Use A Component Library

1. Consult your instructor for what symbol(s) he/she wants you to create. (Remember to name the new symbols.)
2. Create matrix overlay.
3. Add symbol(s) to library that instructor gave you.
4. Plot symbol(s) in new matrix overlay.
5. Save new symbols in library (NOTE: Instructor will give you name to save).
6. Retrieve the stored symbol(s), and display each to check for accuracy.
7. See instructor for specific problems on placing symbols from the library on d.

TASK: DEVELOP AND USE A COMPONENT LIBRARY

TASK # B 10

PERFORMANCE/PRODUCT CHECKLIST

STUDENT'S NAME ______________________ PERFORMANCE ATTEMPT 1 2 3 4

EVALUATOR'S NAME ____________________ DATE OF ATTEMPT ___________

OBJECTIVE:

Given a CAD system, you will DEVELOP AND USE A COMPONENT LIBRARY.

DIRECTIONS TO THE STUDENT:

Before attempting this task for mastery, carefully review this checklist. You will be evaluated on the basis of this checklist. When you feel you are ready for evaluation, contact your instructor. You must score at least 15 out of 15 points, or achieve a score equivalent to 100% for mastery.

DIRECTIONS TO THE EVALUATOR:

The student will contact you when ready for evaluation. The student must score 15 out of 15 points, or achieve a score equivalent to 100% for mastery.

PERFORMANCE/PRODUCT CHECKLIST

B 10

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
1.	Turned on power	--- ---
2.	Inserted proper disks	--- ---
3.	Logged On	--- ---
4.	Retrieved stored drawing or began new drawing	--- ---
5.	Consulted Operator's Manul section on Component Library	--- ---
6.	Created drawings of required symbols	--- ---
7.	Named and stored symbols into computer file	--- ---
8.	Plotted symbol overlay to correct size	--- ---
9.	Retrieved stored symbol from library	--- ---
10.	Placed symbol correctly on drawing	--- ---
11.	Stored drawing	--- ---
12.	Logged off	--- ---
13.	Turned off power	--- ---
14.	Returned all disks to proper storage area	--- ---
15.	Student worked alone	--- ---

TOTAL POINTS EARNED -------

POINTS NEEDED FOR MASTERY --15-

STUDENT LEARNING GUIDE

TASK C 1

EXPLORE THREE DIMENSIONAL GRAPHICS

PURPOSE: In order to fully utilize a CAD system that has three dimensional (3D) capability, an individual must understand the X, Y, Z coordinate input method which generates 3D drawings. Three dimensional drawings can be rotated so that any number of views can be easily achieved.

OBJECTIVE: Given a written exam, you will EXPLORE THREE DIMENSIONAL GRAPHICS. To master this exam, you must answer 31 out of 31 items correctly, or achieve a score equivalent to 100%.

LEARNING STEPS

C 1

READ: Information Sheet C 1.1, "Three Dimensional (3D) Drawings," for an introduction to 3D drawing.

COMPLETE: Activity Sheet C 1.2, "X, Y, and Z Coordinates," for a self-check on 3D drawing.

COMPLETE: Written Exam C 1, EXPLORE THREE DIMENSIONAL GRAPHICS to demonstrate mastery of this task. Contact your instructor.

INFORMATION SHEET

C 1.1

Three Dimensional Drawings

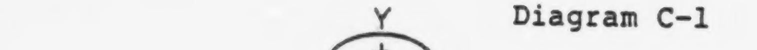
Many CAD systems are capable of making 3D drawings. This capability comes from the software program used by the system.

You are familiar with inputting points using the X and Y coordinates with 2D drawings from Task B 6, Information Sheet B 6.1. CAD systems which are capable of 3D drawings add a third coordinate (Z) which gives depth to an object. By numerically inputting points using X, Y, and Z coordinates, a 3D object can be produced.

The big advantage a 3D system has over a 2D system is that different views can be obtained by rotating the object. Pictorial as well as three view drawings are made by rotating the object around the X, Y, and Z axes.

Diagram C 1 illustrates the X, Y, and Z coordinates in a rotated position. All of the values are positive and the arrows indicate positive rotation. Any placement of points in the opposite direction of the axis shown will have a negative value; also, rotation in the opposite direction of the arrows shown will have a negative rotation.

Diagram C-1



INFORMATION SHEET C 1.1 (continued)

To further help you understand 3D drawing, each of the X, Y, and Z coordinates, has a grid plane of its own. Diagram C 2 shows the relationship of all three coordinates together. Notice that all three coordinate grid planes come together at only one location. This location is the point of entry for a coordinate point of an object.

INFORMATION SHEET C 1.1 (continued)

When starting a drawing using incremental coordinate points, it is necessary to establish a reference point (origin or start point) which will have a value of X=0, Y=0, Z=0. From this point, all other points will be located with either positive or negative values, depending on their relationship to the reference point. Since CAD systems draw from point to point, each point must have an X, Y, and Z value. For example, in diagram C 2, point A has a value of X=1.00, Y=1.50, Z=-1.25. Diagram C 3 illustrates how the box is laid out using .25 increments on the X, Y, Z coordinates.

Diagram C 2

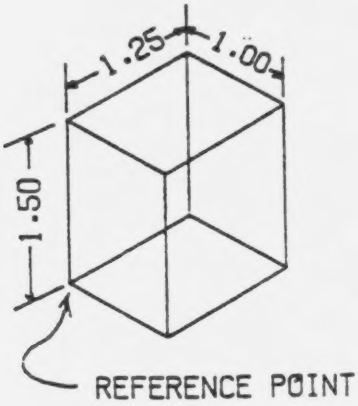
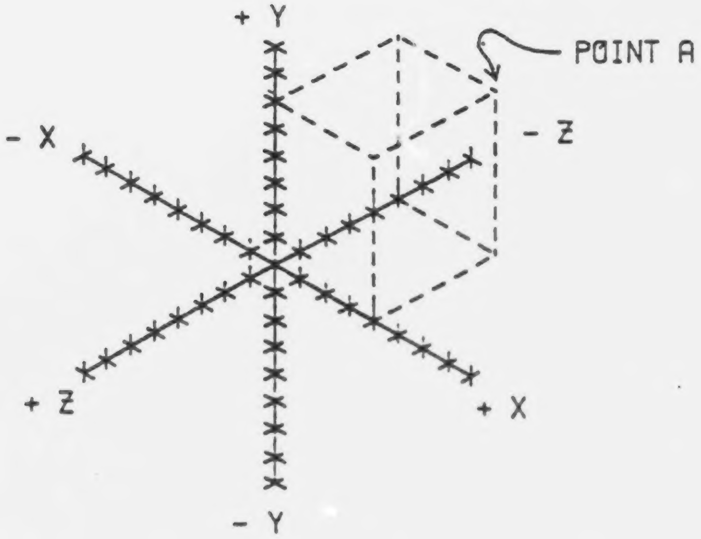


Diagram C 3



ACTIVITY SHEET

C 1.2

X, Y, and Z Coordinates

Using the following coordinates, generate three dimensional objects. Note that each mark equals one inch.

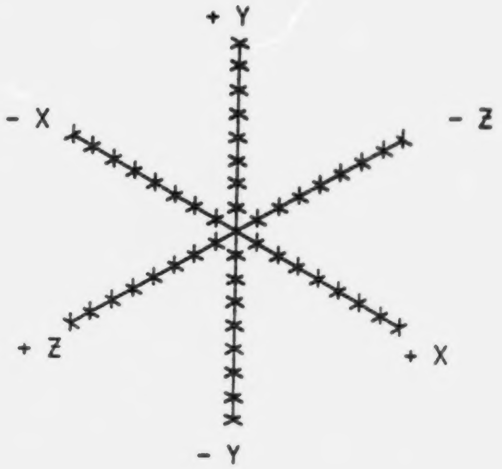
PROBLEMS:

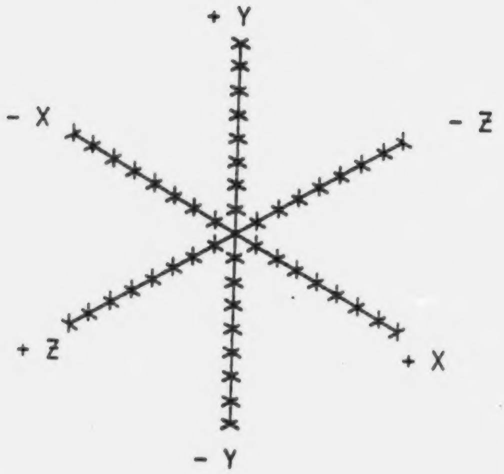
1. X = 2.0
   Y = 2.0
   Z = 2.0

2. X = 2.0
   Y = 3.0
   Z = 2.5

3. X = 3
   Y = 1.5
   Z = -2.5

4. X = 3.5
   Y = 3
   Z = -1.5





EXAM

TASK C 1

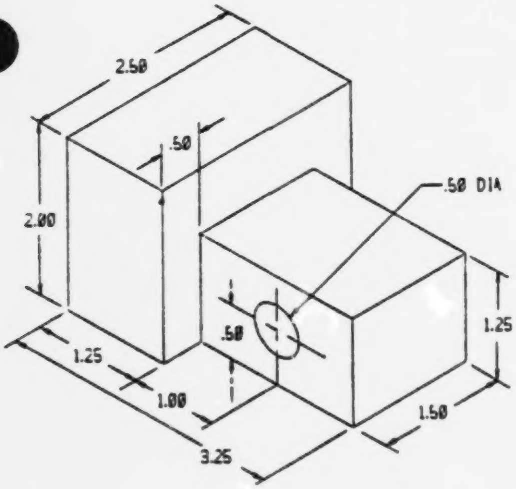
NAME ______________________________

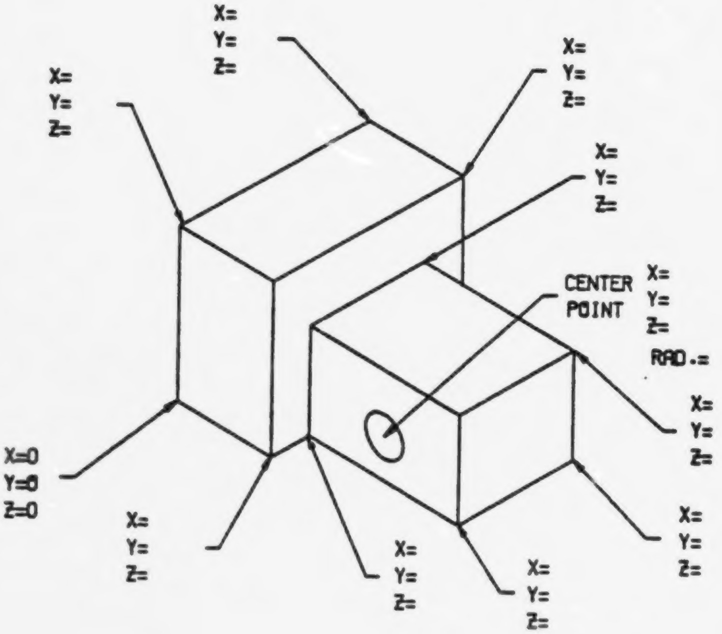
DIRECTIONS:

THE PURPOSE OF THIS EXAM IS TO DETERMINE WHETHER OR NOT YOU HAVE UNDERSTOOD THE INFORMATION ON THREE DIMENSIONAL GRAPHICS.

Using the drawings supplied by your instructor, convert the dimensions to X, Y, and Z coordinate values. DO NOT WRITE ON THIS TEST! To master this exam, you must score 31 out of 31 points, or achieve a score equivalent to 100%.

Using the drawing below, convert the dimensions to X, Y, and Z coordinate values.


2.50
.50
.50 DIA
2.00
.50
1.25
1.25
1.00
1.50
3.25


X=
Y=
Z=
X=
Y=
Z=
X=
Y=
Z=
X=
Y=
Z=
CENTER POINT
X=
Y=
Z=
RAD.=
X=
Y=
Z=
X=0
Y=0
Z=0
X=
Y=
Z=
X=
Y=
Z=
X=
Y=
Z=
X=
Y=
Z=

STUDENT LEARNING GUIDE

TASK C 2

DEFINE THE EYE OF THE VIEWER IN THE 3D DRAWING WORLD

PURPOSE: To effectively create 3D drawings using a CAD system, you must understand how the views seen relate to the "drawing world." You must be able to visualize as well as manipulate these views in the drawing.

OBJECTIVE: Given a CAD system, you will DEFINE THE EYE OF THE VIEWER IN THE DRAWING WORLD. To master this task, you must answer 10 out of 10 items correctly, or achieve a score equivalent to 100% on the Written Exam; and score 15 out of 19 points, or achieve a score equivalent to 79% on the Performance/Product Checklist.

LEARNING STEPS

C 2

READ:	Information Sheet C 2.1, "The Viewing Eye in the 3D Drawing World," for more information on 3D drawings.
COMPLETE:	Activity Sheet C 2.2, "3D Drawing Manipulation," to practice 3D drawings.
COMPLETE:	Performance Checklist C 2, on "3D Drawing Manipulation." Contact your instructor.
COMPLETE:	Written Exam C 2, DEFINE THE EYE OF THE VIEWER IN THE 3D DRAWING WORLD. Contact your instructor.

INFORMATION SHEET

C 2.1

The Viewing Eye in the 3D Drawing World

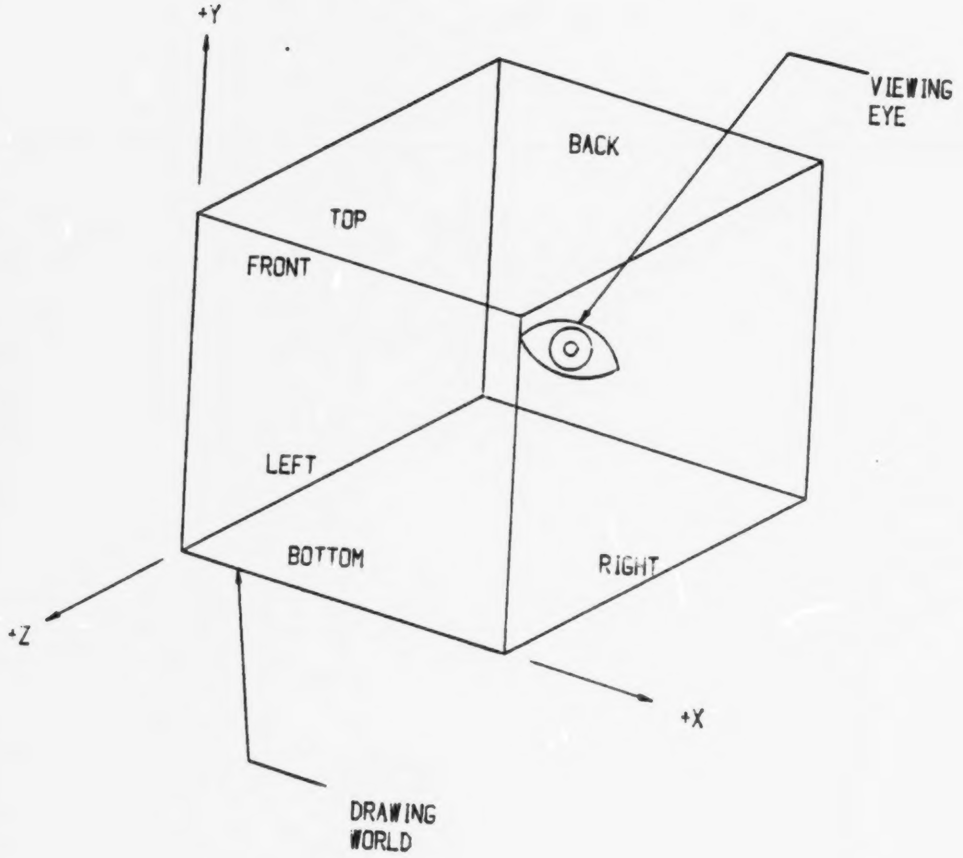
In a 3-Dimensional CAD system, the concept of the drawing world must be clearly understood. The drawing world can be thought of as an empty room. Place an object at a fixed point in the room. This point is the "origin": X=0, Y=0, Z=0. Now imagine yourself moving about the room, the drawing world, taking pictures with a camera. The view through the camera lens becomes the "viewing window." In order to create different views of the object, the position of your eye and the viewing window must move.

The 3D CAD system will produce different views in any of the following ways:

1. Changing angles of rotation;
2. Varying the distance from the origin (Zoom); or
3. Varying the size and position of the viewing area (Window).

INFORMATION SHEET C 2.1 (continued)

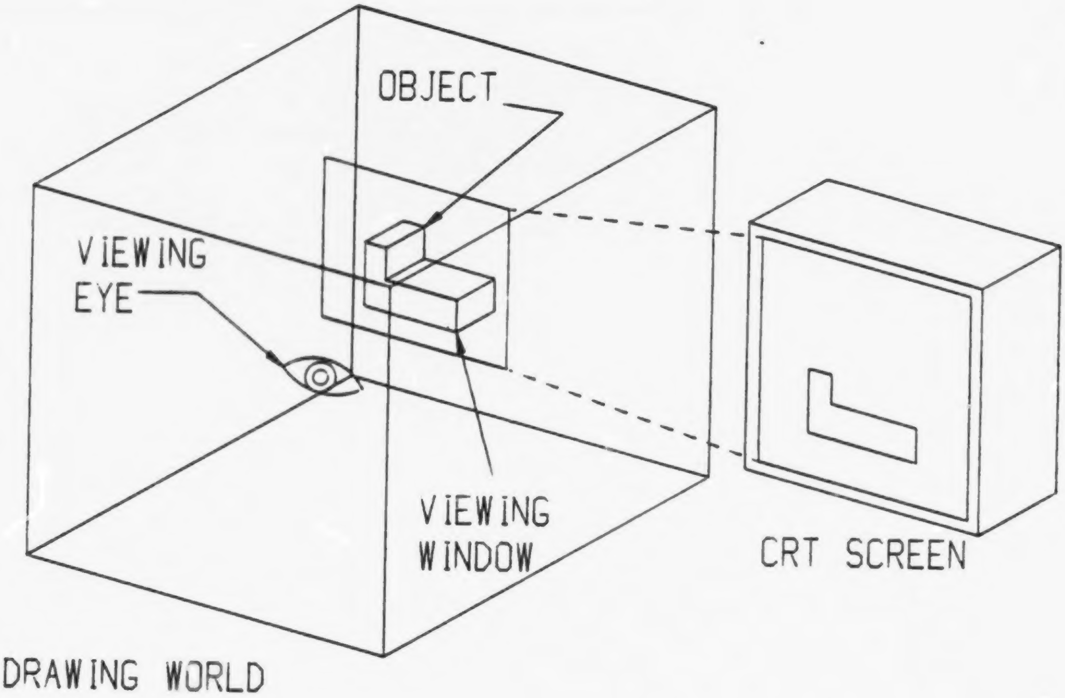
Here is an example of the drawing world in 3-D showing the viewing eye.


+Y
VIEWING EYE
BACK
TOP
FRONT
LEFT
BOTTOM
RIGHT
+Z
+X
DRAWING WORLD

REMEMBER: The viewing eye can move anywhere in the drawing world. The object is always in a fixed position.

INFORMATION SHEET C 2.1 (continued)

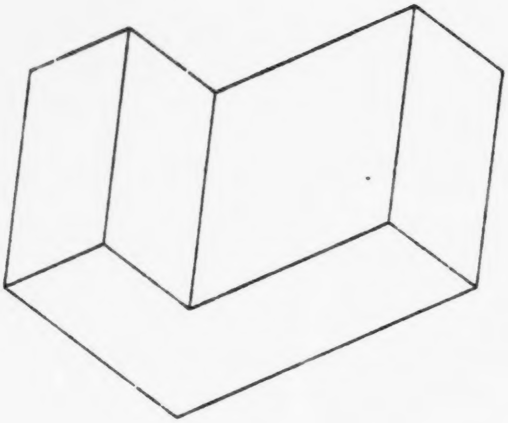
Here is an illustration showing the relationship between the "viewing eye," the "viewing window," and the "drawing world." The view appearing in the "viewing window" is the image seen on the CRT.

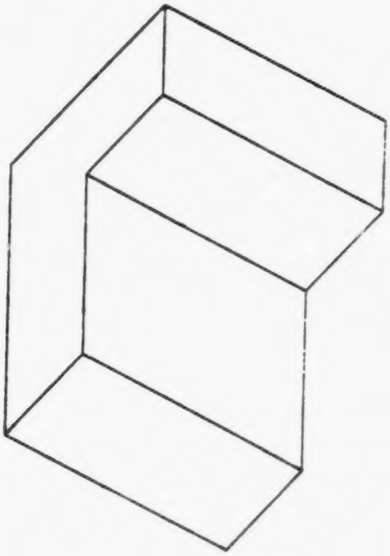

OBJECT
VIEWING EYE
VIEWING WINDOW
CRT SCREEN
DRAWING WORLD

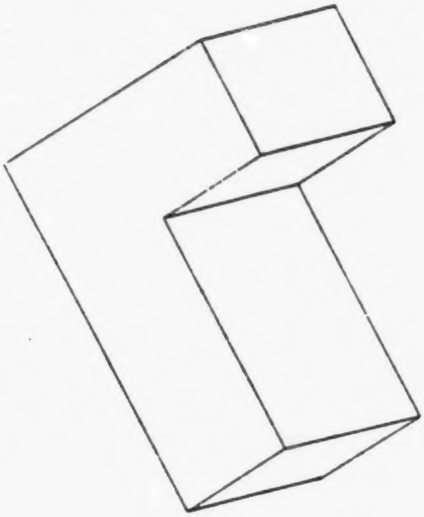
REMEMBER: The object is stationary while the window and eye, move about the drawing.

INFORMATION SHEET C 2.1 (continued)

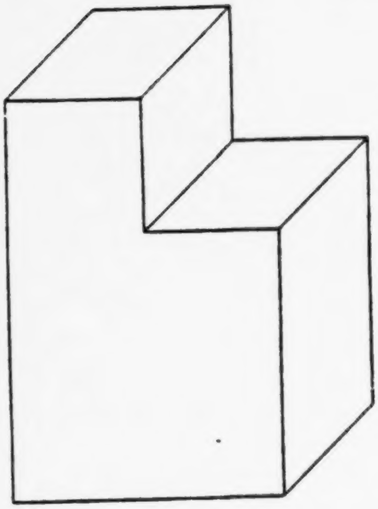
Examples of Rotation



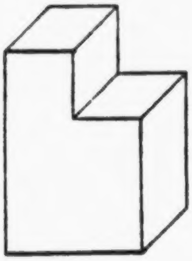




INFORMATION SHEET C 2.1 (continued)

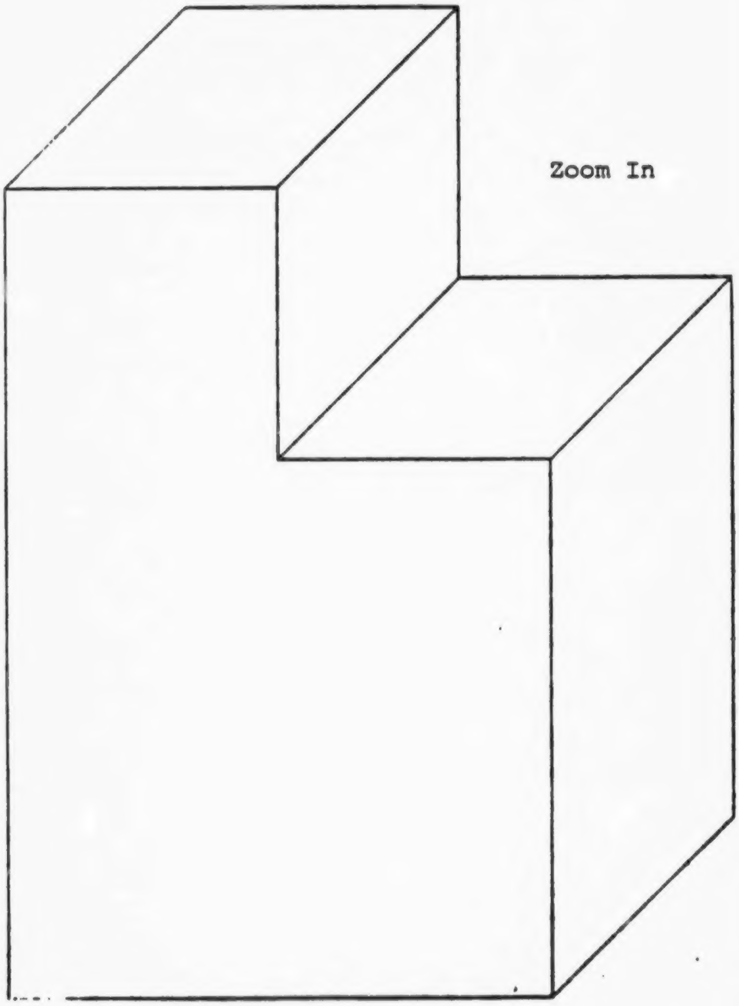


Original View



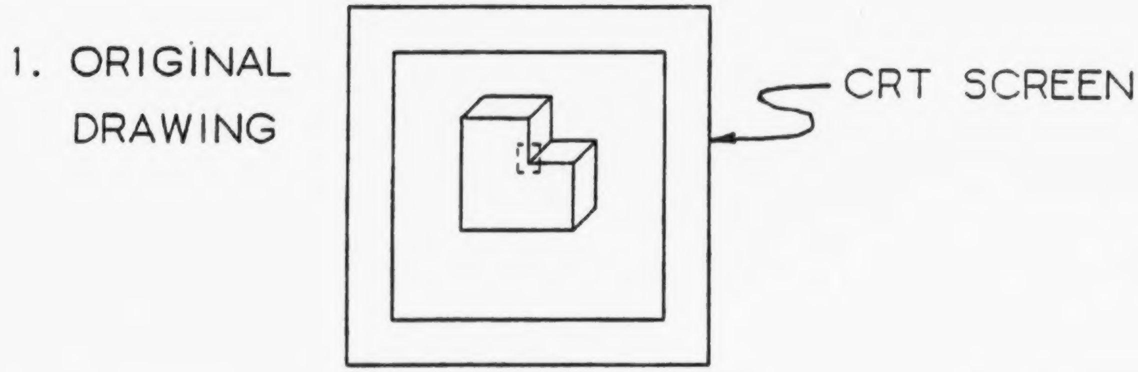
Zoom Out

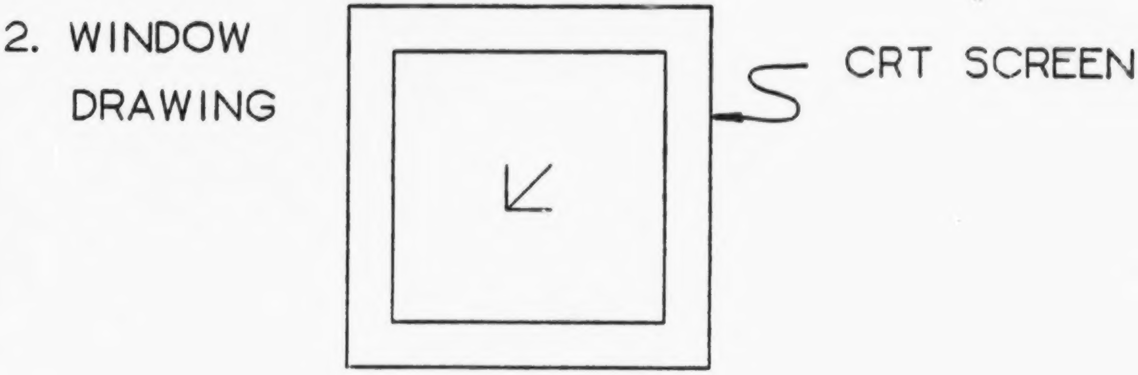
Varying your distance from the origin is another means of changing the way an object appears to the viewing eye. The view and its rotation remains unchanged, but the viewing eye moves closer to or further from the object in a straight line. This results in the object appearing larger or smaller. Some systems are capable of enlarging a portion of the object to provide greater clarity and detail. On most CAD systems, this procedure is known as "Zoom in" and "Zoom out".



Zoom In

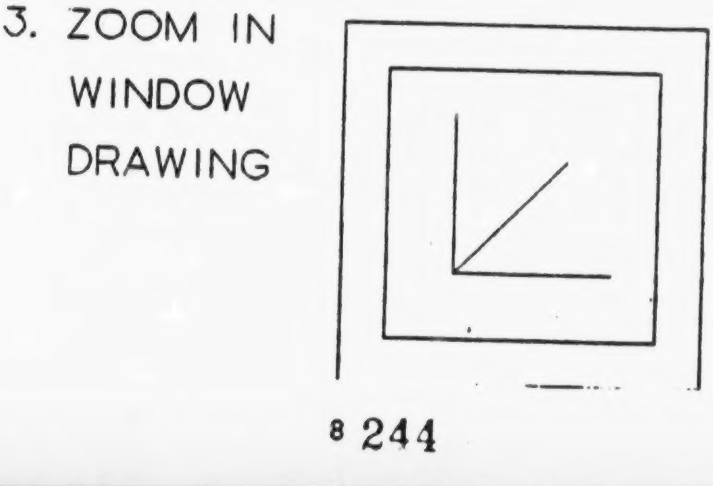
INFORMATION SHEET C 2.1 (continued)


1. ORIGINAL
DRAWING
CRT SCREEN


2. WINDOW
DRAWING
CRT SCREEN

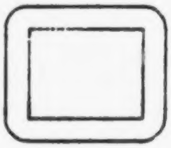
WINDOW

In order to understand the concept of windowing on a CAD system, imagine yourself in a room and looking out the window to see what is outside. What you see in the window depends upon how close you are to it. The closer you are to the window, the more you can see.

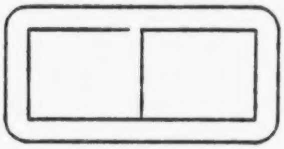

3. ZOOM IN
WINDOW
DRAWING

INFORMATION SHEET C 2.1 (continued)

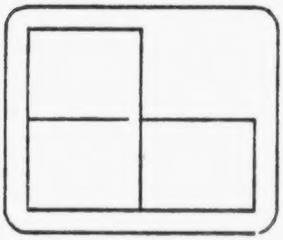
In 3D as well as in 2D, different views may be displayed at the same time. The example below shows a CRT displaying one, two, three, and four views.



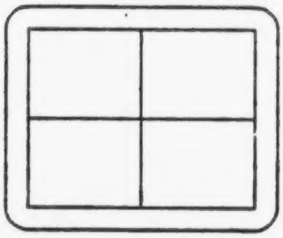
ONE VIEW



TWO VIEWS



THREE VIEWS



FOUR VIEWS

You can show orthographic projections in either one, two, three, or four views. You may also display pictorials or a combination of pictorials and orthographics.

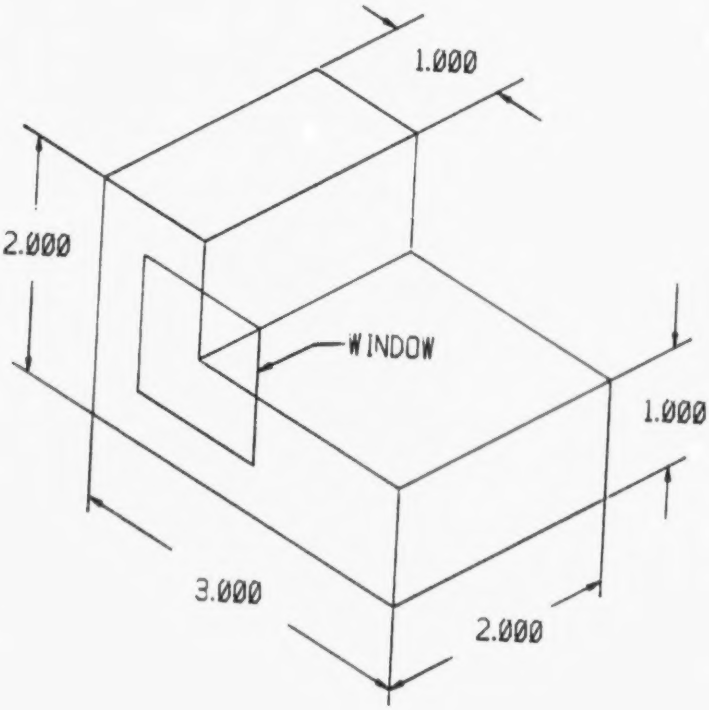
ACTIVITY SHEET

C 2.2

3D Drawing Manipulation

Perform the following operations to practice creating and manipulating a 3D drawing:

1. Consult the Operator's Manual to obtain specific instructions and procedures in the creation and manipulation of 3D drawings.
2. Select an appropriate grid size and create a 3D drawing of the L-Block, below. Do not dimension.



TASK: DEFINE THE EYE OF THE VIEWER IN THE 3D DRAWING WORLD

TASK # C 2

PERFORMANCE/PRODUCT CHECKLIST

STUDENT'S NAME ---------------------- PERFORMANCE ATTEMPT 1 2 3 4

EVALUATOR'S NAME --------------------- DATE OF ATTEMPT -----------

OBJECTIVE:

Given a Cad system, you will DEFINE THE EYE OF THE VIEWER IN THE DRAWING WORLD.

DIRECTIONS TO THE STUDENT:

Before attempting this task for mastery, carefully review this checklist. You will be evaluated on the basis of this checklist. When you feel you are ready for evaluation, contact your instructor. You must score at least 15 out of 19 points, or achieve a score equivalent to 79% for mastery.

DIRECTIONS TO THE EVALUATOR:

The student will contact you when ready for evaluation. The student must score 15 out of 19 points, or achieve a score equivalent to 79% for mastery.

PERFORMANCE/PRODUCT CHECKLIST

C 2

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
1.	Turned on power	--- ---
2.	Booted system	--- ---
3.	Logged on	--- ---
4.	Retrieved stored drawing or started new drawing	--- ---
5.	Used correct grid	--- ---
6.	Created correct view L-Block	--- ---
7.	Showed first rotation	--- ---
8.	Showed second rotation	--- ---
9.	Showed third rotation	--- ---
10.	Showed fourth rotation	--- ---
11.	Performed zoom-on function correctly	--- ---
12.	Performedzoom-out function correctly	--- ---
13.	Displayed window on CRT	--- ---
14.	Performed zoom-in at five times window size	--- ---
15.	Stored drawing	--- ---
16.	Logged off	--- ---
17.	Turned off power	--- ---
18.	Returned all disks to proper storage area	--- ---
19.	Student worked alone	--- ---

TOTAL POINTS EARNED ------

POINTS NEEDED FOR MASTERY --15--

EXAM

Version 1

Task C 2

NAME ------------------------------

DIRECTIONS:

THE PURPOSE OF THIS EXAM IS TO DETERMINE WHETHER OR NOT YOU HAVE UNDERSTOOD THE INFORMATION ON **DEFINE THE EYE OF THE VIEWER IN THE 3D DRAWING WORLD.**

Read each of the following statements and circle the correct answer True or False for each. Use a separate sheet of paper for your answers. DO NOT WRITE ON THIS TEST! To master this exam you must answer **10** out of **10** items correctly, or achieve a score equivalent to 100%.

1. T F The eye of the viewer is always in a fixed position.
2. T F As you change views, the object moves about the drawing world.
3. T F The object is fixed at the X=0, Y=0, Z=0 point.
4. T F Your CRT monitor could be thought of as a drawing world.
5. T F You can view an entire object or any part of it.
6. T F Isometric, trimetric, and oblique views may be displayed on the screen at the same time.
7. T F You may zoom in or zoom out at any time.
8. T F An object may only be rotated around the Z axis.
9. T F You can zoom out to a point far enough that the object would disappear from the CRT screen.
10. T F Up to five different views can be displayed on the screen at the same time.

EXAM

Version 2

Task C 2

NAME ------------------------------

DIRECTIONS:

THE PURPOSE OF THIS EXAM IS TO DETERMINE WHETHER OR NOT YOU HAVE UNDERSTOOD THE INFORMATION ON **DEFINE THE EYE OF THE VIEWER IN THE 3D DRAWING WORLD.**

Read each of the following statements and circle the correct answer True or False for each. Use a separate sheet of paper for your answers. DO NOT WRITE ON THIS TEST! To master this exam you must answer 10 out of 10 items correctly, or achieve a score equivalent to 100%.

1. T F You can zoom out to a point far enough that the object will disappear from the CRT screen.
2. T F Isometric, trimetric, and oblique views may be displayed on the screen at the same time.
3. T F The object is fixed at the X=0, Y=0, Z=0 point.
4. T F You can view an entire object or any part of it.
5. T F Up to five different views can be displayed on the screen at the same time.
6. T F The eye of the viewer is always in a fixed position.
7. T F You may zoom in or zoom out at any time.
8. T F As you change views, the object moves about the drawing world.
9. T F An object may only be rotated around the Z axis.
10. T F Your CRT monitor could be thought of as a drawing world.

STUDENT LEARNING GUIDE

TASK C 3

DEFINE GEOMETRIC MODELING

PURPOSE: A geometric model is a representation of a part's size and shape stored in a computer. Geometric models are considered to be one of the most important elements of CAD/CAM because they are necessary to provide a complete database linking CAD to manufacturing. Modeling also provides better visualization of the part for the designer and manufacturer.

OBJECTIVE: Given a written exam, you will DEFINE GEOMETRIC MODELING. To master this task, you must answer 4 out of 4 items correctly, or achieve a score equivalent to 100%.

LEARNING STEPS

C 3

READ: Information Sheet C 3.1, "Geometric Modeling."

COMPLETE: Activity Sheet C 3.2, "Geometric Modeling," for a self-check on geometric modeling.

COMPLETE: Written Exam C 3 for mastery of this task. Contact your instructor.

INFORMATION SHEET

C 3.1

Geometric Modeling

The simplest and most commonly used method of geometric modeling is called WIRE FRAME. Wire frame modeling represents shapes with interconnected lines that have a "stick figure" appearance. This method uses very little computer time and memory. Disadvantages to wire frame models are that they contain very little information about surfaces, and they don't differentiate between the inside and outside of the object. Wire frame also requires considerable interpretation on the part of the user. We can compare wire framing to an isometric drawing with all of the intersections visible.

Another method of modeling is called SURFACE MODELING. Surface modeling is similar to stretching a thin fabric over a framework. Computers can easily calculate volumes of surface models. Surface models, like wire frame models, don't require very much computer memory. Computers can also remove hidden lines from a surface model for display on a CRT. Two serious drawbacks of surface modeling are that they contain no information describing what lies within the part, and they cannot be used for automatic numerical control programming.

The third method of modeling is called SOLID MODELING. Solid modeling overcomes the drawbacks of both wire frames and surface modeling by defining parts mathematically as solid objects. More processing time and computer memory are required than with the other two types of models. Solid models show interior as well as exterior features and can easily provide the weight and center of gravity of the object. Solid modeling can be compared to an isometric drawing completely shaded in.

ACTIVITY SHEET

C 3.2

Geometric Modeling

1. Using a reference book, list the advantages of geometric modeling on a CAD system.

2. Using your Operator's Manual, list the kinds of geometric models that are used on your CAD system.

3. Research the uses of 3D modeling in industry.

EXAM

Version 1

Task C 3

NAME ______________________________

DIRECTIONS:

THE PURPOSE OF THIS EXAM IS TO DETERMINE WHETHER OR NOT YOU HAVE UNDERSTOOD THE INFORMATION ON DEFINE GEOMETRIC MODELING.

Each of the questions or incomplete statements below is followed by several words, phrases, or a series of numbers. Choose the one(s) which best answer(s) the question or complete(s) the statement correctly. Place the letter associated with that choice (A, B, C, D or E) in the numbered blank space on your ANSWER SHEET. DO NOT WRITE ON THIS TEST! To master this exam, you must answer 4 out of 4 items correctly, or achieve a score equivalent to 100%.

Read the following and circle the best answers for each.

1. Which three kinds of geometric modeling are discussed in the information sheet?

   A. Surface Modeling
   B. Automatic Mesh
   C. Mainframe
   D. Wire Frame
   E. Solids

2. What kind of geometric modeling has a stick figure appearance and uses very little computer memory?

   A. Surface
   B. Mainframe
   C. Solids
   D. Auto Mesh
   E. Wire Frame

EXAM C 3, Version 1 (continued)

3. What kind of geometric modeling allows the computer to remove hidden lines to display on the CRT?

   A. Mainframe
   B. Surface
   C. Solids
   D. Wire Frame
   E. Automatic Mesh

4. What kind of geometric modeling defines parts mathematically, requires more processing time, and shows the interior and exterior features?

   A. Automatic Mesh
   B. Solids
   C. Wire Frame
   D. Surface
   E. Mainframe

EXAM

Version 2

Task C 3

NAME ------------------------------

DIRECTIONS:

THE PURPOSE OF THIS EXAM IS TO DETERMINE WHETHER OR NOT YOU HAVE UNDERSTOOD THE INFORMATION ON **DEFINE GEOMETRIC MODELING.**

Each of the questions or incomplete statements below is followed by several words, phrases, or a series of numbers. Choose the one(s) which best answer(s) the question or complete(s) the statement correctly. Place the letter associated with that choice (A, B, C, D or E) in the numbered blank space on your ANSWER SHEET. DO NOT WRITE ON THIS TEST! To master this exam, you must answer 4 out of 4 items correctly, or achieve a score equivalent to 100%.

Read the following and circle the best answers for each.

1. What kind of geometric modeling allows the computer to remove hidden lines to display on the CRT?

   A. Mainframe
   B. Surface
   C. Solids
   D. Wire Frame
   E. Automatic Mesh

2. Which three kinds of geometric modeling are discussed in the information sheet?

   A. Surface Modeling
   B. Automatic Mesh
   C. Mainframe
   D. Wire Frame
   E. Solids

EXAM C 3, Version 2 (continued)

3. What kind of geometric modeling defines parts mathematically, requires more processing time, and shows the interior and exterior features?

   A. Automatic Mesh
   B. Solids
   C. Wire Frame
   D. Surface
   E. Mainframe

4. What kind of geometric modeling has a stick figure appearance and uses very little computer memory?

   A. Surface
   B. Mainframe
   C. Solids
   D. Auto Mesh
   E. Wire Frame

STUDENT LEARNING GUIDE

TASK C 4

CREATE A 3D (THREE DIMENSIONAL) DRAWING USING CAD

PURPOSE: A three dimensional drawing provides you with enhanced depth perception of an object. When a 3D drawing is developed on a CAD system, many rotational views are available. This provides the user with a better visual understanding of the object.

OBJECTIVE: Given a CAD system, you will CREATE A 3D (THREE DIMENSIONAL) DRAWING USING CAD. To master this task, you must score 20 out of 24 points, or achieve a score equivalent to 83% on the Performance/ Product Checklist.

LEARNING STEPS

C 4

READ: Information Sheet C 4.1, "3D Procedure List," to identify the procedure used to organize your problem.

COMPLETE: Activity Sheet C 4.2, "Create a 3D Drawing Using CAD," to practice creating a 3D drawing.

COMPLETE: Performance/Product Checklist C 4, CREATE A 3D (THREE DIMENSIONAL) DRAWING USING CAD to master this task. Contact your instructor.

INFORMATION SHEET

C 4.1

3D Procedure List

Below is a list of suggested steps that will aid you in organizing your drafting problem.

1. Consult your CAD system's manual on methods of inserting entities using X, Y, and Z coordinates.
2. Boot your system.
3. Name your object or file.
4. Select and use appropriate function to draw object.
5. Save object.
6. Rotate object to get top, front, and right side views.
7. Save each view.
8. Rotate object to create pictorial drawing.
9. Dimension and add text to top, front, and right side views.
10. Add border and title block to drawing.
11. Select and manipulate views to be plotted.
12. Plot drawing.
13. Log off system.
14. Remove disks and shut down system.
15. Turn in drawing and disks to instructor.

ACTIVITY SHEET

C 4.2

Create a 3D Drawing Using CAD

Use the exam problem from Task C 1 and enter the coordinate points to create a 3D drawing on your CAD system. Consult Information Sheet C 4.1 on developing this problem and complete the Performance Checklist with your instructor upon its completion.

TASK: CREATE A 3 D (THREE DIMENSIONAL) DRAWING USING CAD

TASK # C 4

PERFORMANCE/PRODUCT CHECKLIST

STUDENT'S NAME ______________________ PERFORMANCE ATTEMPT 1 2 3 4

EVALUATOR'S NAME ____________________ DATE OF ATTEMPT __________

OBJECTIVE:

Given a CAD system, you will CREATE A 3D (THREE DIMENSIONAL) DRAWING USING CAD.

DIRECTIONS TO THE STUDENT:

Before attempting this task for mastery, carefully review this checklist. You will be evaluated on the basis of this checklist. When you feel you are ready for evaluation, contact your instructor. You must score at least 20 out of 24 points, or achieve a score equivalent to 83% for mastery.

DIRECTIONS TO THE EVALUATOR:

The student will contact you when ready for evaluation. The student must score 20 out of 24 points, or achieve a score equivalent to 83% for mastery.

PERFORMANCE/PRODUCT CHECKLIST

C 4

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
1.	Turned on power	--- ---
2.	Used proper disks	--- ---
3.	Logged on correctly	--- ---
4.	Named drawing	--- ---
5.	Selected functions to numerically input X, Y, and Z coordinate points	--- ---
6.	Entered coordinate points of object	--- ---
7.	Rotated object to create top, front, and right side views	--- ---
8.	Saved each view	--- ---
9.	Rotated object to display pictorial drawing	--- ---
10.	Saved pictorial display	--- ---
11.	Retrieved top, front, and right side views from files and dimensioned each	--- ---
12.	Layed out pictorial and three views for plotting	--- ---
13.	Completed title block and border	--- ---
14.	Prepared printer or plotter for operation	--- ---
15.	Outputted drawing	--- ---
16.	Logged off system	--- ---
17.	Removed disks	--- ---
18.	Turned off system	--- ---

PERFORMANCE/PRODUCT CHECKLIST (continued)

C 4

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
19.	Arranged views correctly	--- ---
20.	Drawing in proportion to paper	--- ---
21.	Placed coordinate points accurately	--- ---
22.	Dimensioned views dimensioned	--- ---
23.	Used correct line types	--- ---
24.	Student worked alone	--- ---

TOTAL POINTS EARNED ------

POINTS NEEDED FOR MASTERY --20--

STUDENT LEARNING GUIDE

TASK D 1

USE A CAD SYSTEM TO PRODUCE AN ARCHITECTURAL DRAWING

PURPOSE: Mastering the technique and skills necessary to efficiently operate a CAD system is an accomplishment of which you can be proud. The true challenge, however, lies in the application of your skills to a practical problem. This task is designed to challenge your skills in using a CAD system to produce an architectural drawing.

OBJECTIVE: Given a CAD system and an architectural problem, you will USE A CAD SYSTEM TO PRODUCE A SET OF ARCHITECTURAL DRAWINGS. To master this task, you must score 145 out of 163 points, or achieve a score equivalent to 89% on a Product/Performance Checklist.

D 1

This architectural problem will consist of the following drawings:

A. Floor Plan
B. Foundation Plan
C. Elevations
D. Details
E. Door and Window Schedule
F. Electrical Plan
G. Plumbing Plan
H. Plot Plan

LEARNING STEPS

D 1

1. Contact your instructor for your architectural problem, and draw a foundation plan.
2. Contact your instructor for evaluation using Product Checklist D 1, Section A.
3. Contact your instructor for your architectural problem, and draw the assigned number of elevations.
4. Contact your instructor for evaluation using Product Checklist D 1, Section B.
5. Contact your instructor for your architectural problem, and draw the assigned number of details.
6. Contact your instructor for evaluation using the Product Checklist D 1, Section C.
7. Contact your instructor for your architectural problem, and draw the assigned door and window schedule.
8. Contact your instructor for evaluation using the Product Checklist D 1, Section D.
9. Contact your instructor for your architectural drafting problem, and draw the assigned electrical wiring diagram.
10. Contact your instructor for evaluation using the Product Checklist D 1, Section E.
11. Contact your instructor for your architectural problem, and draw the assigned plumbing plan.
12. Contact your instructor for evaluation using the Product Checklist D 1, Section F.
13. Contact your instructor for your architectural drafting problem, and draw the plot plan.
14. Contact your instructor for evaluation using Product Checklist D 1, Section G.
15. Contact your instructor for your architectural drafting problem, and draw the plot plan.
16. Contact your instructor for evaluation using Product Checklist D 1 Section H.

TASK: USE A CAD SYSTEM TO PRODUCE AN ARCHITECTURAL DRAWING

TASK # D 1

PERFORMANCE/PRODUCT CHECKLIST

STUDENT'S NAME ______________________ PERFORMANCE ATTEMPT 1 2 3 4

EVALUATOR'S NAME ____________________ DATE OF ATTEMPT __________

OBJECTIVE:

Given a CAD system and an architectural problem, you will USE A CAD SYSTEM TO PRODUCE AN ARCHITECTURAL DRAWING.

DIRECTIONS TO THE STUDENT:

Before attempting this task for mastery, carefully review this checklist. You will be evaluated on the basis of this checklist. When you feel you are ready for evaluation, contact your instructor. You must score at least 145 out of 163 points, or achieve a score equivalent to 90% for mastery.

DIRECTIONS TO THE EVALUATOR:

The student will contact you when ready for evaluation. The student must score 145 out of 163 points, or achieve a score equivalent to 90% for mastery.

PERFORMANCE/PRODUCT CHECKLIST A, FLOOR PLAN

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
1.	Turned on power	--- ---
2.	Used proper disks	--- ---
3.	Logged on	--- ---
4.	Retrieved stored drawings	--- ---
5.	Formatted arrangement of views	--- ---
6.	Selected proper views of each part	--- ---
7.	Used the correct architectural lines and symbols	--- ---
8.	Drawing is properly dimensioned	--- ---
9.	Placed the symbols in the correct location	--- ---
10.	Scaled the drawing correctly	--- ---
11.	Arranged fixtures and furniture in a truly functional manner	--- ---
12.	Showed good traffic pattern in floor plan	--- ---
13.	Emphasized proper kitchen layout	--- ---
14.	Drawing has a complete title block	--- ---
15.	Added section symbols	--- ---
16.	Added floor plan TITLE and SCALE	--- ---
17.	Included proper notes on the plan	--- ---
18.	Followed the local building code specification	--- ---
19.	Used instructor's specified command functions to create the drawing	--- ---

PERFORMANCE/PRODUCT CHECKLIST A, FLOOR PLAN, (continued)

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
20.	Produced specified hard copy	--- ---
21.	Stored drawing	--- ---
22.	Logged off	--- ---
23.	Returned all disks to proper storage area	--- ---
24.	Turned power off	--- ---
25.	Student worked alone	--- ---
	TOTAL POINTS EARNED	------
	POINTS NEEDED FOR MASTERY	--22--

PERFORMANCE/PRODUCT CHECKLIST B, FOUNDATION PLAN

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
1.	Turned on power	--- ---
2.	Used proper disks	--- ---
3.	Logged on	--- ---
4.	Retrieved stored drawings	--- ---
5.	Formatted arrangement of views	--- ---
6.	Selected proper views of each part	--- ---
7.	Used the correct architectural lines and symbols	--- ---
8.	Dimensioned the foundation properly	--- ---
9.	Used the correct scale in the foundation	--- ---
10.	Included a foundation detail	--- ---
11.	Placed the foundation wall the recommended distance above grade	--- ---
12.	Followed the local building code specifications	--- ---
13.	Used the instructor's specified command functions to create the drawing	--- ---
14.	Produced specified hard copy	--- ---
15.	Stored drawing	--- ---
16.	Logged off	--- ---
17.	Returned all disks to proper storage area	--- ---
18.	Turned power off	--- ---
19.	Student worked alone	--- ---

TOTAL POINTS EARNED ------

POINTS NEEDED FOR MASTERY --17--

PERFORMANCE/PRODUCT CHECKLIST C, ELEVATION PLAN

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
1.	Turned on power	--- ---
2.	Used proper disks	--- ---
3.	Logged on correctly	--- ---
4.	Retrieved stored drawings	--- ---
5.	Formatted arrangement of views	--- ---
6.	Selected proper views of each part	--- ---
7.	Used the correct architectural lines and symbols	--- ---
8.	Dimensioned the drawing properly	--- ---
9.	Placed the symbols in the correct location	--- ---
10.	Scaled the drawing correctly	--- ---
11.	Drawing has a complete title block	--- ---
12.	Added section symbols	--- ---
13.	Included notes, title, and scale on each elevation	--- ---
14.	Drew the elevations correctly	--- ---
15.	Assigned elevations were complete	--- ---
16.	Showed below grade construction features	--- ---
17.	Placed the foundation wall the recommended distance above grade	--- ---
18.	Followed the local building code specifications	--- ---
19.	Used the instructor's specified command functions to create the drawing	--- ---

PERFORMANCE/PRODUCT CHECKLIST C, ELEVATION PLAN (continued)

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
20.	Produced specified hard copy	--- ---
21.	Stored drawing	--- ---
22.	Logged off	--- ---
23.	Returned all disks to proper storage area	--- ---
24.	Turned power off	--- ---
25.	Student worked alone	--- ---

TOTAL POINTS EARNED ------

POINTS NEEDED FOR MASTERY --22--

PERFORMANCE/PRODUCT CHECKLIST D, DETAILS

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
1.	Turned on power	--- ---
2.	Used proper disks	--- ---
3.	Logged on	--- ---
4.	Retrieved stored drawings	--- ---
5.	Formatted arrangement of views	--- ---
6.	Selected proper views of each detail	--- ---
7.	Assigned details were complete and accurate	--- ---
8.	Included notes, titles, and scales	--- ---
9.	Used proper symbols in correct location	--- ---
10.	Used proper teminology	--- ---
11.	Used correct scales	--- ---
12.	Used section views properly	--- ---
13.	Used elevations properly	--- ---
14.	Followed local building code specifications	--- ---
15.	Used the instructor's specified command functions to create the drawing	--- ---
16.	Produced specified hard copy	--- ---
17.	Stored drawing	--- ---
18.	Logged off	--- ---
19.	Returned all disks to proper storage area	--- ---

PERFORMANCE/PRODUCT CHECKLIST D, DETAILS (continued)

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
20.	Turned power off	--- ---
21.	Student worked alone	--- ---
	TOTAL POINTS EARNED	------
	POINTS NEEDED FOR MASTERY	--19--

PERFORMANCE/PRODUCT CHECKLIST E, DOOR AND WINDOW SCHEDULE

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
1.	Turned on power	--- ---
2.	Used proper disks	--- ---
3.	Logged on correctly	--- ---
4.	Retrieved stored drawings	--- ---
5.	Formatted arrangement of views	--- ---
6.	Used the proper symbols for window and door identification	--- ---
7.	Included manufacturer information on sizes, styles, and materials in the schedule format	--- ---
8.	Followed the local building code specifications	--- ---
9.	Used the instructor's specified command functions to create the drawing	--- ---
10.	Produced specified hard copy	--- ---
11.	Stored drawing	--- ---
12.	Logged off	--- ---
13.	Returned all disks to proper storage area	--- ---
14.	Turned power off	--- ---
15.	Student worked alone	--- ---

TOTAL POINTS EARNED ------

POINTS NEEDED FOR MASTERY --13--

PERFORMANCE/PRODUCT CHECKLIST F, ELECTRICAL

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
1.	Turned on power	--- ---
2.	Used proper disks	--- ---
3.	Logged on	--- ---
4.	Retrieved stored drawings	--- ---
5.	Formatted arrangement of views	--- ---
6.	Selected proper views	--- ---
7.	Used the proper electrical lines and symbols	--- ---
8.	Indicated the service entrance symbol and capacity	--- ---
9.	Placed the symbols in the correct location	--- ---
10.	Drawing has a complete title block	--- ---
11.	Included notes, titles, and scale	--- ---
12.	Followed the local building code specifications	--- ---
13.	Included a lighting fixture schedule	--- ---
14.	Included a circuit data schedule	--- ---
15.	Used the instructor's specified command functions to create the drawing	--- ---
16.	Produced specified hard copy	--- ---
17.	Stored drawing	--- ---
18.	Logged off	--- ---

PERFORMANCE/PRODUCT CHECKLIST F, ELECTRICAL (continued)

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
19.	Returned all disks to proper storage area	--- ---
20.	Turned power off	--- ---
21.	Student worked alone	--- ---

TOTAL POINTS EARNED -----

POINTS NEEDED FOR MASTERY --19--

PERFORMANCE/PRODUCT CHECKLIST G, PLUMBING

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
1.	Turned on power	--- ---
2.	Used proper disks	--- ---
3.	Logged on	--- ---
4.	Retrieved stored drawings	--- ---
5.	Formatted arrangement of views	--- ---
6.	Selected proper views	--- ---
7.	Used proper plumbing lines and symbols	--- ---
8.	Placed the symbols in the correct location	--- ---
9.	Included notes, titles, and scale	--- ---
10.	Followed the local building code specifications	--- ---
11.	Used the instructor's specified command functions to create the drawing	--- ---
12.	Produced specified hard copy	--- ---
13.	Stored drawing	--- ---
14.	Logged off	--- ---
15.	Returned all disks to proper storage area	--- ---
16.	Turned power off	--- ---
17.	Student worked alone	--- ---

TOTAL POINTS EARNED ------

POINTS NEEDED FOR MASTERY --15--

PERFORMANCE/PRODUCT CHECKLIST H, PLOT PLAN

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
1.	Turned on power	--- ---
2.	Used proper disks	--- ---
3.	Logged on correctly	--- ---
4.	Retrieved stored drawings	--- ---
5.	Formatted arrangement of views	--- ---
6.	Selected proper views of each part	--- ---
7.	Designed the building to fit the plot plan	--- ---
8.	Included in the plot plan are topographical features	--- ---
9.	Placed the proper architectural line symbols in the correct location	--- ---
10.	Placed the symbols in the correct location	--- ---
11.	Scaled the drawing properly	--- ---
12.	Drawing has a complete title block	--- ---
13.	Followed the local building code specifications	--- ---
14.	Used the instructor's specified command functions to create the drawing	--- ---
15.	Produced specified hard copy	--- ---
16.	Stored drawing	--- ---
17.	Logged off	--- ---
18.	Returned all disks to proper storage area	--- ---

PERFORMANCE/PRODUCT CHECKLIST H, PLOT PLAN (continued)

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
19.	Turned power off	--- ---
20.	Student worked alone	--- ---

TOTAL POINTS EARNED ------

POINTS NEEDED FOR MASTERY __18__

STUDENT LEARNING GUIDE

TASK D 2

USE A CAD SYSTEM TO PRODUCE AN ELECTRICAL SCHEMATIC DRAWING

PURPOSE:	Mastering the technique and skills necessary to efficiently operate a CAD system is an accomplishment of which you can be proud. The true challenge, however, lies in the application of your skills to a practical problem. This task is designed to challenge your skills in using a CAD system to produce an Electrical Schematic drawing.
OBJECTIVE:	Given a CAD system and an electrical circuit problem, you will USE A CAD SYSTEM TO PRODUCE AN ELECTRICAL SCHEMATIC DRAWING. To master this task, you must score 16 out of 18 items correctly, or achieve a score equivalent to 89% on the Performance/Product Checklist.

LEARNING STEPS

D 2

CONTACT:	Your instructor for a problem and produce the drawing.
COMPLETE:	Product Checklist D 2 to demonstrate mastery of this task.

TASK: USE A CAD SYSTEM TO PRODUCE AN ELECTRICAL SCHEMATIC DRAWING

TASK # D 2

PERFORMANCE/PRODUCT CHECKLIST

STUDENT'S NAME ______________________ PERFORMANCE ATTEMPT 1 2 3 4

EVALUATOR'S NAME ____________________ DATE OF ATTEMPT __________

OBJECTIVE:

Given a CAD system and an electrical circuit problem, you will USE A CAD SYSTEM TO PRODUCE AN ELECTRICAL SCHEMATIC DRAWING.

DIRECTIONS TO THE STUDENT:

Before attempting this task for mastery, carefully review this checklist. You will be evaluated on the basis of this checklist. When you feel you are ready for evaluation, contact your instructor. You must score at least 16 out of 18 points, or achieve a score equivalent to 90% for mastery.

DIRECTIONS TO THE EVALUATOR:

The student will contact you when ready for evaluation. The student must score 16 out of 18 points, or achieve a score equivalent to 90% for mastery.

PERFORMANCE/PRODUCT CHECKLIST

D 2

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
1.	Turned on power	--- ---
2.	Used proper disks	--- ---
3.	Logged on	--- ---
4.	Retrieved stored drawings	--- ---
5.	Drew a true electrical schematic drawing	--- ---
6.	Used proper component symbols	--- ---
7.	Completed the circuit(s)	--- ---
8.	Circuit shows common ground	--- ---
9.	Schematic drawing is clean	--- ---
10.	Completed title block	--- ---
11.	Used border lines	--- ---
12.	Used instructor's specified command functions to create drawing	--- ---
13.	Produced specified hard copy	--- ---
14.	Stored drawing	--- ---
15.	Logged off	--- ---
16.	Returned all disks to proper storage area	--- ---
17.	Turned power off	--- ---
18.	Student worked alone	--- ---

TOTAL POINTS EARNED ------

POINTS NEEDED FOR MASTERY --16--

STUDENT LEARNING GUIDE

TASK D 3

USE A CAD SYSTEM TO PRODUCE A PRINTED CIRCUIT BOARD DRAWING

PURPOSE: Mastering the technique and skills necessary to efficiently operate a CAD system is an accomplishment of which you can be proud. The true challenge, however, lies in the application of your skills to a practical problem. This task is designed to challenge your skills in using a CAD system to produce printed circuit board drawing.

OBJECTIVE: Given a CAD system and a printed circuit problem, you will USE A CAD SYSTEM TO PRODUCE A PRINTED CIRCUIT BOARD DRAWING. To master this task, you must score 19 out of 21 points, or achieve a score equivalent to 90% on the Performance/Product Checklist.

LEARNING STEPS

D 3

CONTACT:	Your instructor for problem and produce the drawing of a printed circuit board.
COMPLETE:	The Product Checklist D 3 to demonstrate mastery of this task. Contact your instructor.

TASK: USE A CAD SYSTEM TO PRODUCE A PRINTED CIRCUIT BOARD DRAWING

TASK # D 3

PERFORMANCE/PRODUCT CHECKLIST

STUDENT'S NAME ____________________ PERFORMANCE ATTEMPT 1 2 3 4

EVALUATOR'S NAME ____________________ DATE OF ATTEMPT __________

OBJECTIVE:

Given a CAD system and a printed circuit problem, you will USE A CAD SYSTEM TO PRODUCE A PRINTED CIRCUIT BOARD DRAWING.

DIRECTIONS TO THE STUDENT:

Before attempting this task for mastery, carefully review this checklist. You will be evaluated on the basis of this checklist. When you feel you are ready for evaluation, contact your instructor. You must score at least 19 out of 21 points, or achieve a score equivalent to 90% for mastery.

DIRECTIONS TO THE EVALUATOR:

The student will contact you when ready for evaluation. The student must score 19 out of 21 points, or achieve a score equivalent to 90% for mastery.

PERFORMANCE/PRODUCT CHECKLIST

D 3

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
1.	Turned on power	--- ---
2.	Used proper disks	--- ---
3.	Logged on	--- ---
4.	Retrieved stored drawing	--- ---
5.	Runs are solid (i.e., no breaks)	--- ---
6.	Spaced runs in accordance to standards	--- ---
7.	Runs are of proper thickness	--- ---
8.	Used proper component symbols	--- ---
9.	Used a common ground	--- ---
10.	Drawing is clean (i.e., photographable)	--- ---
11.	Drilled holes accurately	--- ---
12.	Proportioned correctly size of the drawing to real board	--- ---
13.	Completed title block	--- ---
14.	Used border lines	--- ---
15.	Used instructor specified command functions to create drawing	--- ---
16.	Produced specified hard copy	--- ---
17.	Stored drawing	--- ---
18.	Logged off	--- ---

PERFORMANCE/PRODUCT CHECKLIST (continued)

D 3

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
19.	Returned all disks to proper storage area	--- ---
20.	Turned power off	--- ---
21.	Student worked alone	--- ---

TOTAL POINTS EARNED ------

POINTS NEEDED FOR MASTERY --19--

STUDENT LEARNING GUIDE

TASK D 4

USE A CAD SYSTEM TO PRODUCE A WIRING DIAGRAM DRAWING

PURPOSE: Mastering the technique and skills necessary to efficiently operate a CAD system is an accomplishment of which you can be proud. The true challenge, however, lies in the application of your skills to a practical problem. This task is designed to challenge your skills in using a CAD system to produce a wiring diagram drawing.

OBJECTIVE: Given a CAD system and a wiring diagram problem, you will USE A CAD SYSTEM TO PRODUCE A WIRING DIAGRAM DRAWING. To master this task, you must score 16 out of 18 points, or achieve a score equivalent to 89% on the Performance/Product Checklist.

LEARNING STEPS

D 4

CONTACT:	Your instructor for problem and produce the wiring diagram drawing.
COMPLETE:	The Product Checklist D 4 to demonstrate mastery of this task. Contact your instructor.

TASK: USE A CAD SYSTEM TO PRODUCE A WIRING DIAGRAM DRAWING.

TASK: D 4

PERFORMANCE/PRODUCT CHECKLIST

STUDENT'S NAME ______________________ PERFORMANCE ATTEMPT 1 2 3 4

EVALUATOR'S NAME ____________________ DATE OF ATTEMPT ___________

OBJECTIVE:

Given a CAD system and a wiring diagram problem, you will USE A CAD SYSTEM TO PRODUCE A WIRING DIAGRAM DRAWING.

DIRECTIONS TO THE STUDENT:

Before attempting this task for mastery, carefully review this checklist. You will be evaluated on the basis of this checklist. When you feel you are ready for evaluation, contact your instructor. You must score at least 16 out of 18 points, or achieve a score equivalent to 90% for mastery.

DIRECTIONS TO THE EVALUATOR:

The student will contact you when ready for evaluation. The student must score 16 out of 18 points, or achieve a score equivalent to 90% for mastery.

PERFORMANCE/PRODUCT CHECKLIST

D 4

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
1.	Turned on power	--- ---
2.	Used proper disks	--- ---
3.	Logged on	--- ---
4.	Retrieved stored drawings	--- ---
5.	Drew a TRUE wiring diagram	--- ---
6.	Used proper component symbols	--- ---
7.	Circuit shows common ground	--- ---
8.	Completed the circuit(s)	--- ---
9.	Produced a clean drawing	--- ---
10.	Completed title block	--- ---
11.	Used border lines	--- ---
12.	Used instructor's specified command functions to create drawing	--- ---
13.	Produced specified hard copy	--- ---
14.	Stored drawing	--- ---
15.	Logged off	--- ---
16.	Returned all disks to proper storage area	--- ---
17.	Turned power off	--- ---
18.	Student worked alone	--- ---

TOTAL POINTS EARNED ------

POINTS NEEDED FOR MASTERY __16__

STUDENT LEARNING GUIDE

TASK D 5

USE A CAD SYSTEM TO PRODUCE MECHANICAL WORKING DRAWINGS

PURPOSE: Mastering the technique and skills necessary to efficiently operate a CAD system is an accomplishment of which you can be proud. The true challenge, however, lies in the application of your skills to a practical problem. This task is designed to challenge your skills in using a CAD system to produce mechanical working drawings.

OBJECTIVE: Given a CAD system and a drafting problem, you will USE A CAD SYSTEM TO PRODUCE MECHANICAL WORKING DRAWINGS. To master this task, you must score 41 out of 45 points, or achieve a score equivalent to 90% on the Performance/Product Checklist.

LEARNING STEPS

D 5

CONTACT: Your instructor for the assigned mechanical drafting problem.

COMPLETE: A working detail drawing.

CONTACT: Your instructor for evaluation using Product Checklist D 5.A.

COMPLETE: An assembly drawing for the assigned problem (after evaluation of your detailed problem).

CONTACT: Your instructor for evaluation using Product Checklist D 5.B.

TASK: USE A CAD SYSTEM TO PRODUCE MECHANICAL WORKING DRAWINGS

TASK # D 5

PERFORMANCE/PRODUCT CHECKLIST

STUDENT'S NAME ______________________ PERFORMANCE ATTEMPT 1 2 3 4

EVALUATOR'S NAME ____________________ DATE OF ATTEMPT ___________

OBJECTIVE:

Given a CAD system and a drafting problem, you will USE A CAD SYSTEM TO PRODUCE MECHANICAL WORKING DRAWINGS.

DIRECTIONS TO THE STUDENT:

Before attempting this task for mastery, carefully review this checklist. You will be evaluated on the basis of this checklist. When you feel you are ready for evaluation, contact your instructor. You must score at least 41 out of 45 points, or achieve a score equivalent to 90% for mastery.

DIRECTIONS TO THE EVALUATOR:

The student will contact you when ready for evaluation. The student must score 41 out of 45 points, or achieve a score equivalent to 90% for mastery.

PERFORMANCE/PRODUCT CHECKLIST

D 5.A

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
1.	Turned on power	--- ---
2.	Used proper disks	--- ---
3.	Logged on	--- ---
4.	Retrieved stored drawings	--- ---
5.	Formatted arrangement of views	--- ---
6.	Selected proper views of each part	--- ---
7.	Used correct line styles	--- ---
8.	Used proper sectioning techniques	--- ---
9.	Used correct dimensioning techniques	--- ---
10.	Used notes correctly	--- ---
11.	Used tolerances where specified	--- ---
12.	Used cell library where applicable	--- ---
13.	Developed parts list	--- ---
14.	Completed title block	--- ---
15.	Used border lines	--- ---
16.	Used instructor's specified command functions to create drawing	--- ---
17.	Produced specified hard copy	--- ---
18.	Stored drawing	--- ---
19.	Logged off	--- ---
20.	Returned all disks to proper storage area	--- ---

PERFORMANCE/PRODUCT CHECKLIST D 5.A (continued)

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
21.	Turned power off	--- ---
22.	Student worked alone	--- ---

TOTAL POINTS EARNED ------

POINTS NEEDED FOR MASTERY --20--

PERFORMANCE/PRODUCTH CHECKLIST

D 5.B

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
1.	Turned on power	--- ---
2.	Used proper disks	--- ---
3.	Logged on	--- ---
4.	Retrieved stored drawings	--- ---
5.	Correct arrangement of views	--- ---
6.	Selected proper assembly views	--- ---
7.	Used correct line styles	--- ---
8.	Selected appropriate sections (if needed)	--- ---
9.	Used appropriate cross hatching	--- ---
10.	Used correct dimensioning technique	--- ---
11.	Used correct representation for fasteners (if needed)	--- ---
12.	Included all assigned parts in assembly	--- ---
13.	Used balloons and leaders	--- ---
14.	Matched balloon number with parts list and use	--- ---
15.	Used cell library where applicable	--- ---
16.	Completed title block	--- ---
17.	Used instructor's specified command functions to create drawing	--- ---
18.	Produced specified hard copy	--- ---
19.	Stored drawing	--- ---
20.	Logged off	--- ---

PERFORMANCE/PRODUCT CHECKLIST D 5.B (continued)

CRITICAL ITEMS	ITEMS TO BE OBSERVED	RATING YES/NO
21.	Returned all disks to proper storage area	--- ---
22.	Turned off power	--- ---
23.	Student worked alone	--- ---
	TOTAL POINTS EARNED	------
	POINTS NEEDED FOR MASTERY	--21--

APPENDIX

A

ANSWER KEYS

TO EXAMS

EXAM ANSWER KEYS

VERSION 1

A1	A2	A3	A4
1. B	1. E	1. B	A. 1. B
2. C	2. B	2. TRUE	2. C
3. D	3. D	3. D	3. A
4. C	4. B	4. B	4. D
5. E	5. D	5. A	B. 1. C
6. C	6. A	6. C	2. A
7. A	7. C	7. B	3. B
8. B	8. A	8. E	4. D
9. D	9. D		
10. E			
11. F			
12. D			
13. C			
14. B			

A 5		A 6		A 7	
1.	O	1.	F	1.	F
2.	I	2.	E	2.	E
3.	I	3.	B	3.	D
4.	P	4.	I	4.	G
5.	I	5.	G	5.	I
6.	O	6.	C	6.	B
7.	I	7.	D	7.	A
8.	I	8.	H	8.	H
9.	O	9.	A	9.	C
10.	I	10.	J		
11.	I				
12.	I				
13.	I				
14.	C				
15.	D				
16.	E				
17.	A				
18.	B				

EXAM ANSWER KEYS

VERSION 2

A1	A2	A3		A4
1. C	1. D	1. B	A.	1. D
2. B	2. D	2. B		2. C
3. B	3. E	3. C		3. A
4. E	4. C	4. TRUE		4. B
5. D	5. B	5. D	B.	1. D
6. D	6. A	6. E		2. C
7. C	7. D	7. A		3. A
8. A	8. A	8. B		4. B
9. C	9. B			
10. B				
11. D				
12. B				
13. C				
14. F				

	A 5	A 6	A 7
1.	O	J	I
2.	I	B	D
3.	I	I	B
4.	I	H	F
5.	I	D	H
6.	P	G	G
7.	O	F	C
8.	I	C	A
9.	I	A	E
10.	O	G	
11.	I		
12.	I		
13.	I		
14.	O		
15.	B		
16.	E		
17.	C		
18.	A		

EXAM ANSWER KEY

B 1

VERSION 1

1. T
2. F
3. F
4. T
5. F
6. F
7. F
8. T
9. T

B 1

VERSION 2

1. T
2. T
3. F
4. F
5. F
6. T
7. F
8. T
9. F

EXAM ANSWER KEY

B 8

VERSION 1

1. D
2. B
3. A
4. C
5. B
6. D
7. B
8. B

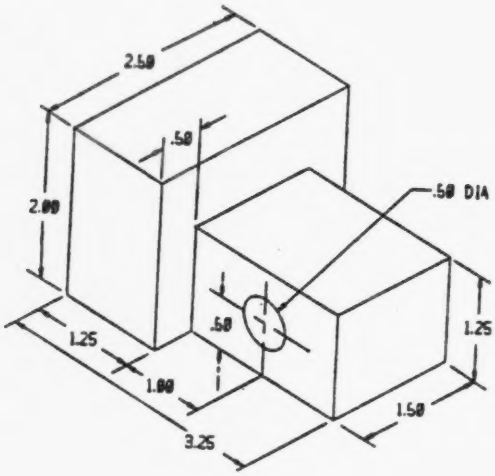
B 8

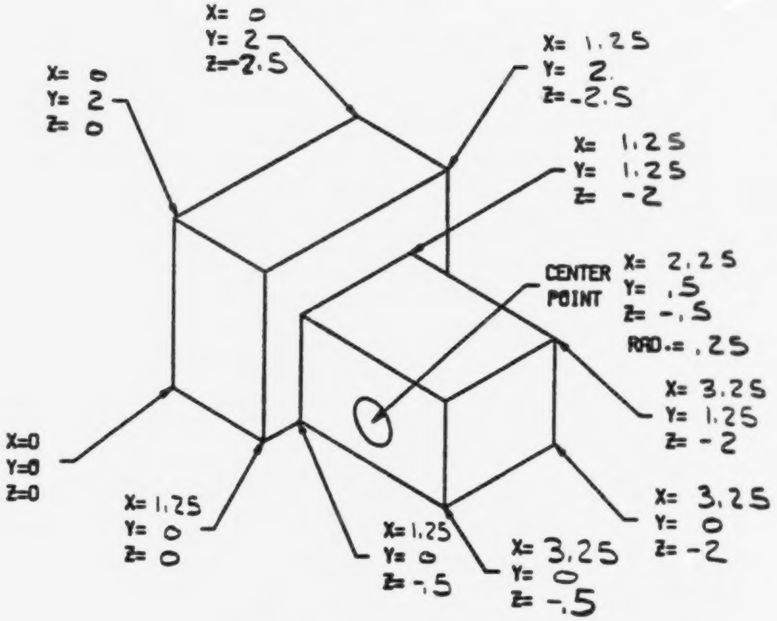
VERSION 2

1. B
2. D
3. D
4. B
5. B
6. C
7. B
8. A

EXAM ANSWER KEY

C 1


2.50
.50
2.00
.50 DIA
.50
1.25
1.25
1.00
1.50
3.25


X= 0
Y= 2
Z=-2.5
X= 0
Y= 2
Z= 0
X= 1.25
Y= 2
Z=-2.5
X= 1.25
Y= 1.25
Z= -2
CENTER POINT
X= 2.25
Y= .5
Z= -.5
RAD.= .25
X= 3.25
Y= 1.25
Z= -2
X=0
Y=0
Z=0
X= 1.25
Y= 0
Z= 0
X= 1.25
Y= 0
Z= -.5
X= 3.25
Y= 0
Z= -.5
X= 3.25
Y= 0
Z= -2

EXAM ANSWER KEY

VERSION 1

C 2

1. F
2. F
3. T
4. T
5. T
6. T
7. T
8. F
9. T
10. F

C 3

1. A, D, E
2. E
3. B
4. B

VERSION 2

C 2

1. T
2. T
3. T
4. T
5. F
6. F
7. T
8. F
9. F
10. T

C 3

1. B
2. A, D, E
3. B
4. E

APPENDIX

B

MATH/SCIENCE
CONCEPT ANALYSIS

APPENDIX

This appendix consists primarily of an analysis of the science and mathematics concepts that are considered prerequisite or co-requisite to understanding the content of the CAD curriculum. The science and mathematics concepts are considered those that _can_ be taught or _should_ be taught as part of the CAD curriculum. Without a good grasp of the concepts included in this appendix, students are likely to have difficulty understanding the basic concept of the CAD program. Also included in the appendix is a secondary analysis which identifies many concepts associated with establishing a strong work ethic and developing good communication skills. The concepts produced by this secondary analysis are also very important to understanding what is necessary to function effectively in the area of computer aided design.

The initial concept analysis was done by identifying all the concepts associated with each objective and/or task. This procedure produced a list that indicated which concepts were connected with a task, but the concepts were so diffused that it was difficult to identify the general science and mathematics themes that are associated with the CAD program. Therefore, the concepts were grouped around theme areas wherever possible. For example, in science, all the concepts associated with electricity were grouped together. This adjustment made it possible to identify the science and mathematics areas involved and it made it possible to determine how an area was distributed across the components of the CAD curriculum.

Using The List

There are two ways to use the list depending on whether your interest lies with identifying how a science or mathematics area is distributed across the CAD curriculum or whether a particular objective or task has science or mathematics concepts associated with it. Both of these ways to use the list are described below.

If your interest in the science and mathematics analysis lies with identifying how a science or mathematics area is distributed across the CAD curriculum, first find that area in the themes/concept list. Then, locate the number associated with that area (the theme number) in the table and read horizontally across the table. The numbers which appear in the various columns indicate how many times the concepts associated with the theme you have chosen appear in connection with the respective tasks and objectives. For example, if you were interested in problem solving you would go to the number six (6) in the left-most column of the table and begin to read horizontally across the table. You would find that something dealing with problem solving appears six (6) times in A1, five(5) times in A1, two(2) times in B6, etc.

If your interest in the science and mathematics analysis lies with identifying which science and mathematics areas are associated with a particular task or objective, you would find the appropriate letter and number combination in the task/objective heading and read vertically down the list. Each time you encounter a number, this indicates that a science or mathematics area is associated with an objective the number of times that corresponds to the number you have encountered. By reading horizontally to the left, you can determine which area is involved.

The chart prepared for this appendix was developed to be "user friendly." As a result, it is easy to identify quickly which science, mathematics, etc. concepts are associated with the various tasks and objectives included in the CAD curriculum. To achieve this simplicity, some details have been sacrificed. In particular, it is not possible to identify each concept associated with a specific task or objective. However, with the entire range of concepts that might be associated with a task or an objective identified in the theme group, it is relatively easy to recognize which concepts are included. The more detailed list has been saved and can be made available to those who wish more detailed information about the initial steps in the analysis.

For more information regarding this analysis, contact:

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A 1 Describe the Operator-Machine Interface in Computer Aided Drafting

problem-solving, knowledge of technologies, uses of specific technologies

A 1.1 Introduction to Computers

forms (concepts) of communication, techniques (methods) of communications, uses of computers, types of machines, compound machines, record data, analyze data, efficiency, cost-benefit ratios, values of computers, magnetism, speed, rate, accuracy, fatigue, problem-solving, input, output, concept(s) of technology

mathematics:

number systems, organizing data, recording data, interpreting data, basic mathematical skills/computations,

computers:

construction (design) of computers, history of computers, impact of computers, data processing, logical thinking, systems, subsystems, limitations, programming, rules, keyboard, memory, devices for communication, interaction

work ethic:

following directions, learning basic rules, acquiring knowledge, keeping up-to-date

A 1.3 Introduction to Computer Aided Drafting

concept of technology, uses of knowledge, curiosity/creativity, uses of computers, concept of problem-solving, symbols and equations, relationships, concept of technology to device, automation, uses of technologies, limitation, limiting factors, interaction

drafting: concept of measurement, approximation, precision, units of measurement, scale drawing, efficiency,accuracy, model-building, symbolism, instrumentation, development of language, forms of communications

computer: electrical circuits, magnetism, polarity, electrical impulses, electronics, programming cathode ray tube (CRT): excitation, energy levels, operation of CRT, uses of CRT

flow charts, dichotomous decisions, deductive logic, classification

A 2 Identify CAD Applications

uses of knowledge, uses of technology, uses of computers, forms of technology, uses of specific technologies

A 2.1 CAD Applications

rate, speed, inductive reasoning, deductive reasoning, logical thinking, uses of computers, uses of computers in business and industry, assets, debits, budget, cost-effective, forms of technology, career education, societal concerns

prediction, estimation, properties and behavior of materials, recording data, graphing, profit and loss

creativity, creative thinking, model building, problem-solving, analysis of data, recording data, decision-making, model-building, interpreting data, simulations, programming

A 3 Describe CAD Systems

system, types of computer systems, recognition of attributes, classification

A 3.1 Types of CAD Systems

history of communication, number systems, types of communication devices, recording data, data management, types of data records, types of number systems, forms (systems) of communication, units of measurement, counting, powers of ten, uses of computers, rate, efficiency, magnetism, polarity, types of computers, history of computers, classification, degree-of-fit, 3-dimensional space, volume, electrical impulses, cost, limits/limitations, capacity, model-building, uses of specific computer systems

A 3.2 Glossary of Common CAD Terms

4. model-building, inference
5. electrical circuits, electrical impulses, operation of CRT, uses of CRT, excitation

7. system, subsystem

15. bytes, magnetism, fields

A 4 Describe the Rolė of CAD System Personnel

career education, job-preparation, job responsibilities, uses of computers, multiple-use

A 4.1 CAD System Personnel

System Manager: need to plan and organize, gather data, acquire knowledge, keep up-to-date, give directions, forms of reporting, preparing reports, analyze data, manage time, learn leadership skills, accept responsibility

Graphics Designer: develop organizational skills, develop systems of communication, prepare reports, understand forms of communication, develop and conduct training programs, time management, plan ahead, gather data, record data, report data, quality control, compare to standards, think analytically, develop systems, be able to classify/categorize, willing to perform lower-level tasks at appropriate times

Graphics Operator: follow directions, strive for perfection, acquire knowledge and skills, perform routine tasks, willing to perform duties of other jobs

CAD Programmer: develop systems, collect and organize materials, developing training programs, communicate with others, keep up-to-date, assist others in keeping up-to-date, desire quality work, seek personal and company improvement

A 5 Identify the Components of a CAD Work Station

identify attributes, interpret data, interpret diagrams, system, subsystem, component, develop vocabulary, key language

A 5.1 Input Devices

data transformation
photo sensitive, excitation, compound machines, coordinates, graphing

A 5.3 CAD Components

science: systems model-building, mental images, uses of CRT, operation of CRT, construction and uses of graphs, electrical impulses, recording data,coordinates,schematic diagrams

mathematics: functions

A 6 Interpret and Identify ANSI CAD Terms

A 7 Maintain and Care for a CAD System

A 7.1 Care and maintenance procedures regarding hardware and its environment

Environment (classroom/lab):

Work ethic

safety
follow rules/directions
respect for property (leave it better than you found it); care of property, preventive maintenance

acquire basic knowledge behind rules
- static electricity, causes of static electricity, preventing charge build-up
- magnetism, magnetic field, electrical circuits
- corrosion, properties of materials
- chemical reactions
- heat effects, short circuits, grounding

Communication

write good directions, how to sequence, categorize

Hardware

follow rules for safety and care of property
develop routines/habits to provide preventive maintenance

A 7.3 Care and Maintenance of Floppy Disks

learn rules of proper care

properties of materials that affect operation of disk, e.g. what "de-magnetizes materials"

A 8 Describe Command Processes

A 8.1 Commands and Functions

logical thinking, decision-making, model building, schematic diagram, logical sequence, flow charts, precision, linear sequences, language development

A 9 Start-Up, Log/On, Retrieve, Save, Log/Off and Shut-down a CAD System

A 9.1 Log/On, Log/Off Procedures

use rules, logical thinking, systems, sequence, follow directions

A 9.2 Retrieve From and Save To a Storage File

magnetize, follow instructions, logical sequences, model building

A 10 Use and Manage a Drawing File System

reaction time, fatigue, time management, planning, task completion

A 10.1 Use and Manage a Drawing File System

recording data, communicating results, developing systems, efficiency, problem-solving, developing logical sequences, partitioning, taxonomies and labelling, spatial relations, magnetic fields, random numbers, sample and populations, magnitude

A 11 Use CAD Operating Modes

flowcharts, following directions, basic geometric figures, patterns, spatial relations, coordinates, communication, scales, units of measurement, concentric circles, developing systems, following rules

B 1 Set Up a Two Dimensional Grid System

spatial relations, coordinates, scaling, units of measurement, construction of graphs, development of physical and mental models

B 1.1 Grids

points, line segments, 2-dimensional figures, spatial relationships, construction of graphs, estimating distances, units of measurement, coordinates, construction of mental and physical models, scaling, technologies for measuring, planes, values, relative position, horizontal, vertical

work habits, following directions, organizing for communicating

following directions, striving for accuracy, checking for accuracy, working cooperatively

B 2 Create a Hard Copy Using a Printer and/or a Plotter

forms of communication, physical representation

B 2.1 A Hard Copy from a Printer

successive approximations, credibility, accuracy, precision, repetition, trade-offs, cost-benefit ratios, advantage, disadvantage, communication techniques, heat sensitive, energy conversions, speed, relative effects

checking your work

B 2.3 A Hard Copy from a Plotter

accuracy, precision, career education, coordinates, constructing graphs, recording data, energy conversion, systems, machines, uses of technology, classification, follow directions

B 3 Create, Manipulate, and Edit Text

B 3.1 Create Text

development of language and symbols for communicating, symbols as a form of communication

B 3.3 Manipulating Text

change of position, scale models, relative position

B 3.5 Editing Text

accuracy

B 4 Select Appropriate Geometry to Create Lines, Circles, and Arcs

properties of basic geometric figures, follow directions

B 4.1 Construction of Lines

developing physical and mental models, construction of geometric figures, construction of graphs, logical sequences, deductive logic, following directions (rules)carefully, writing directions for effective communication, uses of mathematical knowledge, checking your work

B 4.3 Construction of Circles

Constructing geometric figures, properties of geometric figures, developing mental and physical models, uses of mathematical knowledge (coordinates, geometric shapes), alternative models, prediction, forms of communication, following directions, units of measurement

B 4.5 Construction of Arcs

following directions, alternative models, working with others, checking your work

B 4.7 Edit and Delete Options

successive approximation

B 5 Select Appropriate Geometry to Create Curves, Tangents, Fillets, Chamfers, and Bevels

working for accuracy and being precise, developing mental and physical models, creative and critical thinking, problem-solving techniques, analysis and synthesis, logical reasoning, set and subset, part-whole relationships, need for practice, scaling, classification

B 5.1 Construction of Curves

following directions, practice makes perfect, construction of models, uses of coordinates, degree of fit

B 5.3 Create Tangents with Lines and Arcs

basic geometric figures, properties of geometric figures, basic geometric concepts, intersection, tangent, rules for operational definitions, uses of geometric knowledge, function following directions, use of basic procedures, part-whole relationships, working for accuracy, checking your work

B 5.5 Creating Fillets, Rounds, Chamfers, and Bevels

formulating definitions, learning to follow directions, importance of following directions, use of references, books as forms of communication

practicing to develop skills, following directions

B 6 Manipulate Geometric Shapes

identify and manipulate variables, drawing to scale, magnification, coordinates, precision, prediction, types of images, systems and subsystems

B 6.1 Coordinate Systems

graphs, constructing graphs, axes, coordinates, systems, subsystems, place value,magnitude, position and motion, Cartesian coordinates, polar coordinates, point, line segment, relative position/frame of reference, origin, delta (change), increment, absolute, forms of communication, creating models

angle, radius, degree, vertical, horizontal, clockwise, counter-clockwise, rotation, arc, reference point

recording data, interpreting data, reading and interpreting graphs/diagrams

B 6.3 Rotation and Zoom

magnification, expansion, scale drawings, ratios, proportion, rotation, rotation on axis, angles, degrees, behavior of lenses

building models, scaling, measurement, arc, degrees, following directions, mental images

B 6.5 Mirror and Copy Option

introductory optics, image, mirror image, reflection, angle of reflection, reverse image, reference point, frames of reference

B 6.7 Aligning and Moving an Object

relative position, frames of reference, origin, point

B 6.9 Adding Components

deductive logic, classification/categories, part-whole relationships, problem-solving, create models

techniques for constructing basic geometric shapes, identify basic geometry terminology

B 7 Dimension Shapes

B 7.1 Dimensioning Shapes

part-whole relationships, constructing models, scale drawing, describing properties, using properties to communicate, units of measurement, forms of communication, ordering, serial ordering, vectors, labelling diagrams, physical models

following directions, rules, learning and following procedures

B 8 Use Digitizing Techniques to Copy Existing Drawings

forms of communication, using symbols to communicate, languages for communication

B 8.1 Digitizing Techniques

coordinates, organizing data, magnetic fields, electro-magnetic impulses, photoelectric, electrical impulses, energy conversion, magnetized, system, subsystem, interpret data, technologies, excitation, operation of lenses, uses of technologies

uses of scientific knowledge, career education

B 9 Use Layering Techniques

B 9.1 Layering Techniques

drawing to scale, units of measurement, developing perceptual skills, relative position and motion, part-whole relationships, multiple images, transparent, uses of knowledge

B 10 Develop and Use a Component Library

standards, symbols, forms of communication

B10.1 Component Library

standards, conventions and rules, labelling systems

operational definitions, uses of symbols, symbols as a form of communication, developing communication skills, concept labels, schematic diagrams, classification,system, subsystem, efficiency, sampling by replacement

following directions, developing good work habits, safety

C 1 Explore Three Dimensional Graphics

3-dimensional space, spatial relations, coordinates

C 1.1 Three Dimensional Graphics

coordinates, perception, spatial relations, observation, models, rotate, vector, relative position, plane, increment

C 2 Define the Eye of the Viewer in the 3D Drawing World

3-dimensional space, spatial relations, create mental images,

C 2.1 The Viewing Eye in the 3D Drawing World

3-dimensional space, origin, coordinates, mental images, point of view, objectivity, observation, relative position, angle, perception, magnification, operation of lenses, focal length

C 3 Define Geometric Modeling

model building, geometric figures, characteristics attributes of objects, observation, 3-dimensional space, relative position, images, mental and physical models

C 3.1 Geometric Modeling

model building, isomers, volume, 3-dimensional space, solid

C 4 Create a 3D (Three Dimensional) Drawing Using CAD

observation, perception, depth perception, relative position, mental image, 3-dimensional space

C 4.1 3D Procedure List

D 1 Use a CAD System to Produce an Architectural Drawing

following procedures, working together, following directions, quality control, checking your work

D 2 Use a CAD System to Produce an Electrical Schematic Drawing

problem-solving, using equipment properly, uses of scientific knowledge, uses of technology, forms of communication, communicating with symbols, developing skills, practicing

D 3 Use a CAD System to Produce a Printed Circuit Board Drawing

problem-solving, using equipment properly, uses of scientific knowledge, uses of technology, forms of communication, communicating with symbols, developing skills, practicing

D 4 Use a CAD System to Produce a Wiring Diagram

problem-solving, using equipment properly, uses of scientific knowledge, uses of technology, forms of communication, communicating with symbols, developing skills, practicing

D 5 Use a CAD System to Produce Mechanical Working Drawings

problem-solving, using equipment properly, uses of scientific knowledge, uses of technology, forms of communication, communicating with symbols, developing skills, practicing

Forms (concepts) of communication; techniques (methods of communications; types of communication devices; devices for communication; forms of communications; history of communications; forms (systems) of communications; develop systems of communication; understand forms of communication; communicate with others; communication; organizing for communicating; communication techniques; development of language and symbols for communicating; symbols as a form of communication; writing directions for effective communication; books as forms of communication; using properties to communicate; using symbols to communicate; languages for communication; developing communication skills; communicating with symbols; communicating results

Data processing; interpreting data; analysis of data; data management; interpret data; analyze data

Record data; organizing data; recording data; report data; gather data

Use of computers; impact of computers; values of computers; programming; keyboard; types of computer systems; types of computers; uses of specific computer systems; bytes; fields; properties of materials that affect operation of disk, e.g., what "demagnetizes materials"; construction (design) of computers; history of computers; uses of computers in business and industry

Following directions; learning basic rules; follow directions; follow directions/rules; acquire basic knowledge behind rules; following rules; striving for accuracy; checking for accuracy; learning and following procedures; following procedures; checking your work; importance of following directions; working for accuracy

Problem-solving; concept of problem solving; dichotomous decisions; deductive logic; inductive reasoning; deductive reasoning; logical thinking; creative thinking; decision-making; think analytically; creative and critical thinking; logical reasoning

Knowledge of technologies; uses of specific technologies; concept(s) of technology, concept of technology to device; uses of technologies; forms of technology; technologies for measuring planes; technologies

Types of machines, compound machines

Systems; subsystems

Magnetism; magnetize; magnetic field; magnetized

Acquiring knowledge; uses of knowledge; acquire knowledge; acquire knowledge and skills

Keeping up-to-date; keep up-to-date; assist others in keeping up-to-date

Number systems; types of number systems; counting; powers of ten

Curiosity; creativity

Concept of measurement; unit of measurement; measurement

Scale drawing; scales; scaling; drawing to scales; scale models

Model building; systems model-building; construction of models; alternative models; developing physical and mental models; building models; creating models; crate models; constructing models; models; mental and physical models; development of physical and mental models

Electrical circuits; electrical impulses

Cathode ray tube (CRT), operating of CRT; uses of CRT

Assets; debits; budget; profit and loss

Reading and interpreting graph/diagrams; construction of graphs; construction and use of graphs, graphs

Management of time; time management

Forms of reporting; preparing reports; prepare reports

Willing to perform lower level tasks; perform routine tasks

Develop and conduct training programs; developing training programs

Properties of materials; properties and behaviors of materials; properties of materials

Respect for property (leave it better than you found it); care of property; preventative maintenance; follow rules for safety and care of property, using equipment properly

Develop vocabulary; language development

Static electricity; causes of static electricity; preventing charge build-up

How to sequence; logical sequences; linear sequences; sequence; developing logical sequences; ordering; serial ordering

Basic geometric figures; properties of basic geometric figures; construction of geometric figures; properties of geometric figures; basic geometric concepts; identify basic geometry terminology; uses of geometric knowledge

Practice makes perfect; need for practice; practicing

Uses of coordinates; coordinates; cartesian coordinates; polar coordinates

	A1	A2	A3	A4	A5	A7	A8	A9	A10	A11	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	C1	C2	C3	C4	D1	D2	D3	D4	D5
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Efficiency	A
Cost-benefit ratios	B
Limitations	C
Rules; use of rules; conventions and rules	D
Speed	E
Rate	F
Memory	G
Accuracy	H
Fatigue	I
Interaction	J
Input	K
Output	L
Basic mathematical skills/computations	M
Symbols; uses of symbols; symbols and equations	N
Relationships	O
Automation	P
Limiting factors	Q
Interaction	R
Approximation	S
Precision	T
Symbolism	U
Instrumentation	V
Development of language	W
Polarity	X
Electronics	Y
Excitation	Z
Energy levels	A1
Classification; be able to classify/categorize; classification/categories	A2
Cost-effective	A3
Career-education	A4
Societal concerns	A5
Predication	A6
Estimation	A7
Simulation	A8
Recognition of attributes; identify attributes; characteristics attributes of objects	A9
Types of data records	A10
Degree-of-fit	A11
3 dimensional space	A12
Volume	A13
Cost	A14
Limits/limitations	A15
Capacity	A16
Inference	A17
Job preparation	A18
Job responsibility	A19
Multiple-use	A20
Need to plan and organize; plan ahead	A21
Learn leadership skills	A22
Accept responsibility	A23
Develop organization skills	A24
Quality control	A25

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	A1	A2	A3	A4	A5	A7	A8	A9	A10	A11	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	C1	C2	C3	C4	D1	D2	D3	D4	D5
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Compare to standards	A
Development systems	B
Strive for perfection	C
Willing to perform duties of other jobs	D
Collect and organize materials	E
Desire quality work	F
Seek personal and company improvement	G
Interpret diagrams	H
Component	I
Key language	J
Data transformation	K
Photosensitive	L
Mental images; create mental images	M
Schematic diagrams	N
Functions	O
Work ethic	P
Corrosion	Q
Chemical reactions	R
Heat effects	S
Short circuits	T
Grounding	U
Write good directions	V
How to sequence; logical sequences; linear sequences	W
Categorize	X
Reaction time	Y
Task completion	Z
Partitioning	A1
Taxonomies and labeling	A2
Sample and populations; sampling by replacement	A3
Patterns	A4
Points	A5
Line segments	A6
2-dimensional figures	A7
Estimating distances	A8
Values	A9
Relative position/frame of reference; relative position; relative position and motion	A10
Horizontal	A11
Vertical	A12
Work habits; developing good work habits	A13
Working cooperatively; working with others	A14
Physical representation	A15
Successive approximations	A16
Credibility	A17
Repetition	A18
Trade-offs	A19
Advantage	A20
Disadvantage	A21
Heat sensitive	A22
Energy conversions	A23
Relative effects	A24
Change of position; position and motion	A25
Uses of mathematical knowledge; uses of mathematical knowledge (coordinates, geometric shapes)	A26

	A1	A2	A3	A4	A5	A7	A8	A9	A10	A11	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	C1	C2	C3	C4	D1	D2	D3	D4	D5
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Problem-solving techniques	A
Analysis and synthesis	B
Part-whole relationship	C
Intersection	D
Tangent	E
Rules for operational definitions; operational definitions	F
Uses of basic procedures	G
Formulating definitions	H
Uses of references	I
Practicing to develop skills	J
Identify and manipulate variables	K
Magnification	L
Types of images; image; mirror image; multiple images; reverse image	M
Axes	N
Place value	O
Magnitude	P
Origin	Q
Delta (change)	R
Increment	S
Absolute	T
Radius	U
Angle	V
Degree	W
Clockwise	X
Counter-clockwise	Y
Rotation	Z
Rotate	A1
Arc	A2
Reference point	A3
Expansion	A4
Ratios	A5
Rotation on axis	A6
Behavior of lenses	A7
Introductory optics	A8
Reflection; angle of reflection	A9
Frames of reference	A10
Techniques for constructing basic geometric shapes; figures	A11
Describing properties	A12
Vectors	A13
Labeling diagrams	A14
Electro-magnetic impulses	A15
Photoelectric	A16
Operation of lenses	A17
Uses of scientific knowledge	A18
Developing perceptual skills	A19
Transparent	A20
Standards	A21
Labeling systems	A22
Concept levels	A23
Perception	A24

	A1	A2	A3	A4	A5	A7	A8	A9	A10	A11	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	C1	C2	C3	C4	D1	D2	D3	D4	D5
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Observation
Plane
Point of view
Objectivity
Isomer
Solid
Depth perception
Develop skills

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G
H

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	A1	A2	A3	A4	A5	A7	A8	A9	A10	A11	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	C1	C2	C3	C4	D1	D2	D3	D4	D5
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APPENDIX

C

DRAFTING TASK LIST

WITH CAD CROSSWALK

NOTE: This crosswalk is designed to assist the drafting instructor in relating the Computer Aided Drafting curriculum to the state recommended Drafter/Computer Aided Drafter task list.

DRAFTER/COMPUTER-AIDED DRAFTER

Duty A: Planning and Organizing Activities

Tasks:
1 Determine scope of a drafting job
2 Determine numbers and sizes of drawings
3 Apply appropriate drafting standards to drawings
4 Select appropriate drafting techniques for assigned drawings
5 Maintain supporting documents for drawing files A9

Duty B: Researching Information

Tasks:
1 Locate information using manufacturers' catalogs
2 Locate information using engineering handbooks
3 Locate information using microfilm files
4 Locate information using computer data files A9
5 Confirm materials availability
6 Research architectural graphic standards

Duty C: Performing General Office Procedures

Tasks:
1 Maintain client rapport
2 Participate in client conferences
3 Interpret plans
4 Coordinate work with engineering personnel
5 Coordinate work with welding shop personnel
6 Coordinate work with sheet metal shop personnel
7 Coordinate architectural drawings
8 Coordinate civil drawings
9 Coordinate structural drawings
10 Coordinate mechanical drawings
11 Coordinate electrical drawings
12 Coordinate other drawings
13 Check plan dimensions
14 Maintain drafting instruments and equipment
15 Clean drafting instruments and equipment
16 File original working drawings A7, A9
17 Maintain and care for CAD work station A6
18 Start up, log/on, retrieve, save, log/off and shut down CAD system A8
19 Analyze and communicate equipment failure
20 Produce schedules

Duty D: Preparing Sketches

Tasks:
1 Draw freehand sketches
2 Draw isometric sketches
3 Draw orthographic sketches
4 Draw pictorial sketches
5 Read and transfer measurements
6 Prepare proportional design sketches
7 Draw oblique sketches

Duty E: Performing Basic Layouts

Tasks:	1	Work from written instructions to produce drawings	
	2	Work from verbal instructions to produce drawings	
	3	Perform basic layouts to specified tolerances	
	4	Render designs in pencil	

Duty F: Detailing Drawings

Tasks:	1	Draw individual parts from assembly drawings	
	2	Draw individual parts from existing parts	
	3	Interpret assembly drawings	
	4	Draw orthographic projections	
	5	Draw sectional views	
	6	Draw auxiliary views	
	7	Draw isometric views	
	8	Draw intersection and development drawings	
	9	Dimension and tolerance drawings	
	10	Apply geometric tolerances to drawings	B7
	11	Apply standard fits to drawings	
	12	Apply x-y coordinate dimensioning standards to drawings	B7
	13	Add title block information to drawings	B3
	14	Letter presentation drawings	B3
	15	Note special instructions on drawings	

Duty G: Using Reproduction Techniques

Tasks:	1	Reproduce drawings on blueprint machines	
	2	Reproduce drawings on dry copy machines	
	3	Create hard copy using a plotter	B2
	4	Create hard copy using a printer	B2
	5	Copy existing drawings using digitizing techniques	A10

Duty H: Performing Presentation Techniques

Tasks:	1	Prepare plan abbreviations list	
	2	Produce graphs	
	3	Produce flow diagrams	

Duty I: Producing Architectural Drawings

Tasks:	1	Construct architectural symbols	B10
	2	Produce representative architectural drawings	
	3	Interpret local, state and federal architectural codes	
	4	Complete FHA specification forms	
	5	Check architectural drawings	
	6	Draw presentation floor plans	D1
	7	Draw presentation elevation views	D1
	8	Draw one point interior presentation views	
	9	Draw two point interior presentation views	
	10	Draw exterior perspective views	

		CAD Curriculum
11	Illustrate landscape features	D1
12	Sketch preliminary plan layouts	
13	Sketch preliminary elevations	
14	Sketch preliminary sections	
15	Draw scaled floor plans	D1
16	Draw foundation plans	D1
17	Draw foundation sections	D1
18	Reproduce common plan features	
19	Draw exterior elevations	D1
20	Draw framing plans	D1
21	Draw typical wall sections	D1
22	Draw parapet and roof sections	D1
23	Dimension section drawings	D1
24	Draw stair sections	D1
25	Draw fireplace sections	D1
26	Draw chimney sections	D1
27	Draw door sections	D1
28	Draw window sections	D1
29	Draw bathroom sections	D1
30	Draw cabinet sections and details	D1
31	Draw millwork (trim) sections	D1
32	Draw door and window schedules	D1
33	Draw finish schedules	D1
34	Draw floor sections	D1
35	Draw attic sections	D1
36	Draw shaft sections	D1
37	Draw typical closet sections	D1
38	Prepare residential house plumbing plans	D1
39	Prepare residential house HVAC plans	D1
40	Prepare residential house electrical plans	D1

Duty J: Drawing Light Commercial Building Plans

Tasks:			
	1	Draw commercial building floor plans	D1
	2	Draw commercial building foundation plans	D1
	3	Draw commercial building framing plans	D1
	4	Draw commercial building roof plans	D1
	5	Draw commercial building site plans	D1
	6	Draw commercial building elevations	D1
	7	Construct commercial building section drawings	D1
	8	Prepare commercial building door, window and finish schedules	D1
	9	Prepare commercial building plumbing plans	D1
	10	Prepare commercial building HVAC plans	D1
	11	Prepare commercial building electrical plans	D1
	12	Prepare commercial building landscape plans	D1
	13	Dimension commercial building plans	D1
	14	Check commercial building plans	D1
	15	Prepare commercial building quantity estimates	

Duty K: Producing Structural Working Drawings

Tasks: 1 Construct structural drafting symbols
2 Interpret local, state and federal structural codes

3 Prepare bills of materials from structural drawings
4 Draw structural steel plans
5 Dimension structural steel drawings
6 Draw beam connections
7 Construct column detail drawings
8 Construct detail truss drawings for timber
9 Prepare structural foundation and slab plans
10 Prepare structural floor framing plans
11 Prepare structural roof framing plans
12 Draw structural sections and details
13 Draw structural concrete foundation plans
14 Prepare column and beam schedule for structural steel
15 Prepare column and beam schedule for reinforcing steel
16 Check structural drawings

Duty L: Producing Mechanical Working Drawings

Tasks:
1 Construct mechanical drafting symbols B10
2 Construct sheet metal drafting symbols B10
3 Construct tool design symbols B10
4 Prepare bills of materials from mechanical drawings
5 Produce parts lists for mechanical assembly drawings
6 Construct mechanical orthographic assembly drawings D5
7 Construct mechanical orthographic subassembly drawings D5
8 Detail components of mechanical orthographic assembly drawings D5
9 Detail components of mechanical orthographic subassembly drawings D5
10 Construct mechanical isometric assembly drawings D5
11 Construct mechanical isometric subassembly drawings D5
12 Construct mechanical isometric exploded view drawings D5
13 Construct jig drawings D5
14 Construct fixture drawings D5
15 Construct sheet metal development drawings D5
16 Construct HVAC drawings D5
17 Construct forming die drawings D5
18 Check mechanical drawings D5
19 Design new equipment

Duty M: Producing Electrical and Electronic Working Drawings

Tasks:
1 Construct electrical drafting symbols B10
2 Construct electronic drafting symbols B10
3 Prepare bills of materials from electrical drawings
4 Prepare bills of materials from electronic drawings
5 Interpret local, state and federal electrical codes
6 Draw electrical block diagrams D2
7 Draw electrical schematic diagrams D2
8 Draw electrical connection diagrams D2
9 Draw electronic block diagrams D2
10 Draw electronic schematic diagrams D2
11 Draw electronic connection diagrams D2
12 Draw industrial controls ladder diagrams D2
13 Draw electrical power single-line diagrams D2, D4

Duty N: Producing Civil Engineering Drawings

Tasks:		CAD Curriculum
1	Produce detailed construction drawings	
2	Develop topographical profiles	
3	Develop specification sheets for highway construction	
4	Develop specification sheets for river and harbor improvements	
5	Produce plans for flood control	

Duty O: Using CAD Command Processes

Tasks:		
1	Build data base	A7, B10
2	Edit data base	A7, B10
3	Create plotter files	A7
4	Create disk files	A7, A9, B10
5	Copy disk files	A7, A9
6	Execute specialized programs	
7	Develop backup files	A7, A9, B10
8	Restore backup files	A7, A9
9	Develop configure/control changes	A7, B6
10	Develop execute lists using command language	A7
11	Write simple FORTRAN program	

Duty P: Producing Drawings Using CAD

Tasks:		
1	Generate grid on drawing	B1
2	Select appropriate geometry to create lines, circles and arcs	A10, B4, B8
3	Select appropriate geometry to create curves, tangents, fillets, chamfers and bevels	A10, B5, B8
4	Develop three-dimensional drawings	C1, C2, C4
5	Select appropriate line work, weights and color	B8
6	Apply layering techniques	B9

Employability skills are a vital component of vocational education programs and should be incorporated into each occupational task list.

APPENDIX

D

EMPLOYABILITY SKILLS

EMPLOYABILITY SKILLS

DUTY A: Identifying Employment Opportunities

SKILLS:
1 Identify requirements for job
2 Investigate educational opportunities
3 Investigate occupational opportunities
4 Locate resources for finding employment
5 Confer with prospective employers
6 Identify job trends

DUTY B: Applying Employment Seeking Skills

SKILLS:
1 Locate job openings
2 Document skills and abilities (resume)
3 Prepare for interview
4 Participate in interview
5 Complete required tests
6 Complete required forms
7 Write application letter
8 Write follow-up letter
9 Write acceptance letter
10 Evaluate job offer
11 Evaluate job rejection

DUTY C: Interpreting Employment Capabilities

SKILLS:
1 Match interest to job area
2 Match aptitudes to job area
3 Verify abilities
4 Identify immediate work goal
5 Develop career plan

DUTY D: Demonstrating Appropriate Work Behavior

SKILLS:
1 Exhibit dependability
2 Demonstrate punctuality
3 Follow rules and regulations
4 Recognize the consequences of dishonesty
5 Complete assignments in accurate and timely manner
6 Control emotions
7 Assume responsibility for own decisions and actions
8 Exhibit pride and loyalty
9 Exhibit ability to handle pressures and tensions
10 Demonstrate ability to set priorities
11 Demonstrate problem-solving skills

DUTY E: Maintaining Safe and Healthy Environment

SKILLS:
1 Comply with safety and health rules
2 Select correct tools and equipment
3 Utilize equipment correctly
4 Use appropriate action during emergencies
5 Maintain clean and orderly work area
6 Demonstrate personal hygiene and cleanliness

DUTY F: Maintaining Business-Like Image

SKILLS:
1 Paticipate in company or agency orientation
2 Demonstrate knowledge of company or agency products and services
3 Exhibit positive behavior
4 Read current job-related publications
5 Support and promote employer's company image and purpose
6 Maintain appearance to comply with company standards

DUTY G: Maintaining Working Relationships with Others

SKILLS:
1 Work productively with others
2 Show empathy, respect and support for others
3 Demonstrate procedures and assist others when necessary
4 Recognize, analyze and solve or refer problems
5 Minimize occurence of problems
6 Channel emotional reaction constructively

DUTY H: Communicating on the Job

SKILLS:
1 Read and comprehend written communications and information
2 Use correct grammar
3 Speak effectively with others
4 Use job-related terminology
5 Listen attentively
6 Write legibly
7 Use telephone etiquette
8 Follow written and oral directions
9 Ask questions
10 Locate information in order to accomplish task
11 Prepare written communication
12 Utilize keyboarding skills
13 Utilize computer skills

DUTY I: Adapting to Change

SKILLS:
1 Recognize need to change
2 Demonstrate willingness to learn

3 Demonstrate flexibility
4 Participate in continuing education
5 Seek worth challenges
6 Adjust career goals/plan as needed

DUTY J: Understanding How a Business Works

SKILLS:
1 Recognize the role of business in the enterprise system
2 Identify general responsibilities of employees
3 Identify general responsibilities of management/employers
4 Investigate opportunities and options for business ownership
5 Identify planning processes needed to open a business
6 Participate in meetings

DUTY K: Performing Mathematical Skills

SKILLS:
1 Apply mathematics for problem solving
2 Add and subtract whole numbrs, decimals and fractions
3 Multiply and divide whole numbers, decimals and fractions
4 Convert numbers between forms expressed as fractions, decimals and percents
5 Convert between standard American units of measure
6 Convert between standard American units and metric units

Employability skills are a vital component of vocational education programs and should be incorporated into each occupational task list.